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SEVEN DOLLARS

THE MAGAZINE FOR INFORMATION

COVER STORY:

Imaging And The Corporate Makeover

New Tools To Support Teamwork

AN INTERNATIONAL DATA GROUP PUBLICATION

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The depth of image 44
Cover photo by Lanny Nagler

COVER STORY

The Image Makeover

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Using image technology to get rid of paper turns out to be a merely cosmetic change. The real impact of imaging comes from the workplace transformations it can bring about.

By Richard Pastore

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Team Boosters

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As manufacturing enterprises reorganize into cross-functional teams, CIOs scramble to provide technology tools that will support the new order.

By Allan E. Alter

New Bonds on Wall Street

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Six Wall Street firms have found that when it comes to information technology, working hand-in-hand with the opposition can be highly competitive.

By David Freedman



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Meet the new, reengineered Tripp Strange! He's now a consultant giving bad advice and working like the devil....

By Tripp Strange



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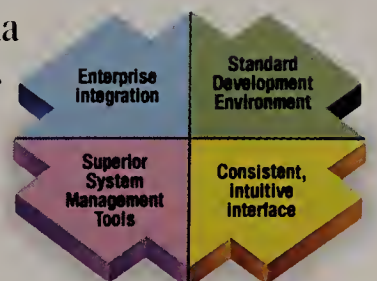
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COLUMNS (continued)

INSIGHTS: THE VIRTUOUS VIRUS

The conventional wisdom is that the only good virus is a dead one. Not everyone agrees.
By Fred Cohen

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STATE OF THE ART: SIMPLIFY, SIMPLIFY

RISC technology is more than just another notch on the price-performance curve—by simplifying complex instructions, computer makers are changing the economics of processing.
By David Freedman

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WORKING SMART: TAKING CARE OF PATIENT DATA

Lutheran Hospital's bedside computing system has helped free nurses from time-consuming clerical work so they can take better care of patients. Doctors and other staff have ready access to accurate, complete data, and overtime costs have been significantly reduced.
By Megan Santosus

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For some time now, we've been hearing that one of the goals of information technology is to remove barriers and facilitate communication among departments and enterprises. This is usually easier said than done. Three of our articles this month explore this theme, in various permutations.

Senior Writer Richard Pastore explains how imaging technology, once relegated to the role of a fancy storage-and-retrieval system, has become a determinant in work-process change. "The Image Makeover," on Page 44, describes how, at many insurance companies, claims processing—once passed from department to de-

partment—is now handled by one person. In addition, many organizations are beginning to see a decrease in the compartmentalization of workers, resulting in the merger of disparate departments. The downside of all this process reengineering is that it requires the additional expense of giving everyone equal access to image systems—a reality that doesn't exactly thrill top management these days. Consequently, analysts estimate that fewer than 30 percent of image implementers undertake significant process changes, making this a technology with much unrealized potential.

A startling example of barrier bashing is the newly formed Electronic Joint Venture Partners, which is jointly owned by six Wall Street trading firms (see "New Bonds on Wall Street," Page 52). Contributing Writer David Freedman describes how these competitors put aside some of their rivalry in favor of pooling IS resources. Their goal: to stave off competition from third-party information brokers while giving the partners a sustainable edge over the rest of the field. These firms have joined forces to build a generic platform, leaving the individual partners time to build competitive strengths.

Finally, Special Projects Editor Allan E. Alter found that teams lead the way to success in the manufacturing environment. Technology tools that allow employees to work as a team regardless of location have become a sought-after solution. But again, change is shown to breed resistance: Not all organizations greet these alterations in the work process with great enthusiasm. "Team Boosters" begins on Page 36.

IT and reengineering go hand in hand. All that remains is the small matter of getting them to journey in sync.

Marcia Blumenthal



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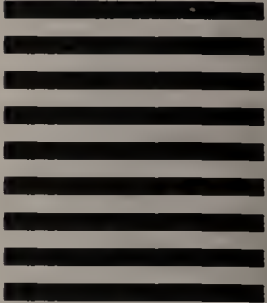
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*Michael Hammer
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In our ongoing discussions with IS executives, we are finding that the metrics used by top management to evaluate corporate performance are expanding beyond the scope of simply monitoring bottom-line financial results. Savvy companies that want to survive for the long-term are now evaluating "softer" but equally important measures, such as business-process competency, cycle time and customer responsiveness.

This trend places tremendous pressure on the CIO, the IS department and the myriad end-user departments throughout the organization that must monitor and report to management on progress and performance based on these new metrics.

Often, existing IT systems can't deliver the required information because they weren't designed to measure business processes or other new criteria. Even if the systems can perform the necessary measurements, IS may not know how to analyze, package and communicate the resulting information, because the corporate-performance paradigm is dramatically different from the traditional financial model.

I believe information technology companies that can deliver to CIOs products and services that measure these new corporate-performance metrics are in a great position to succeed in the 1990s. And those companies that can help CIOs to *define* the new metric set within the context of business-process reengineering will provide a valuable service that goes far beyond simply providing technology as a means to an end.

Wynne L. Lutz

Coming In CIO

The Downsizing Paradox

Downsizing is a trend fraught with anxiety. CIOs cite cost savings as the driving force behind the move—yet they doubt that downsizing will yield big cost savings. In general, CIOs also believe that the mainframe offers better reliability and security than do PC LANs, as well as superior vendor support. "Nonetheless, they're downsizing," said one consultant. *CIO* explores the issues behind this seeming paradox in a special focus section.

Flying High

Rosenbluth Inc. may invest more money in IT than any other travel agency, and it shows. "We're developing systems right now that could replace travel agencies," boasted CEO Hal Rosenbluth, who adds that information services are "our core business." *CIO* looks at the agency's phenomenal success and the IT muscle that underlies it.

Selling IS

Faced with dwindling budgets, more-demanding senior management and a new crop of external competitors for their internal clients, a growing number of CIOs are looking for new ways to market their services and find more effective, timely, economical, *competitive* solutions to users' business problems.

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WALL STREET ETHICS

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COMPUTER PROGRAMMING

Journalists have *Murphy Brown* and attorneys have *L.A. Law*, but computer professionals have been sadly neglected when it comes to TV treatments of the subject they hold most dear. Starting this month, PBS is correcting that oversight with *The Machine That Changed the World*, a five-part series on the history and impact of the computer.

The series kicks off on April 6 at 9 p.m. with "Giant Brains," covering the wartime events that led to the debut of the world's first electronic computer. Subsequent programs, broadcast every Monday through May 4, look at the computer's evolution, proliferation and social impact, and at the potential of artificial intelligence. Industry pioneers including Bill Gates, Steve Wozniak, Steve Jobs and Mitch Kapor are featured.

The Machine that Changed the World is a collaboration between the makers of *Nova* and the BBC. ■

THEY WERE BUILT TO PLAY

On a February night, an overflow crowd of Massachusetts college kids gathered to witness an annual spectacle. As fellow students faced each other in head-to-head competition, cheers and heckling pierced the arena. At stake was nothing less than campus bragging rights.

No, this wasn't a Big East basketball rivalry, but a more esoteric competition: MIT's 6th Annual "6.270" Contest, better known as Robo-Cup.

The contest is the culmination of a student-created course in which teams design, build and program robots. Working with a standard kit

including LEGO, Polaroid motors, electronic sensors and a microprocessor board, the students' only assignment is to build an artificially intelligent soccer-playing robot that will beat the MIPS out of the competition.

This year's Robo-Cup featured 50 teams. During a

45-second period, two robots competed to propel ping-pong balls into their goals. While blocking and interference were allowed, using glue and going after the opponent's microprocessor resulted in immediate disqualification.

Top honors went to Dizzy Devil, the brainchild of Marcus Kramer, Sumer Johal and Chris Ward. ■



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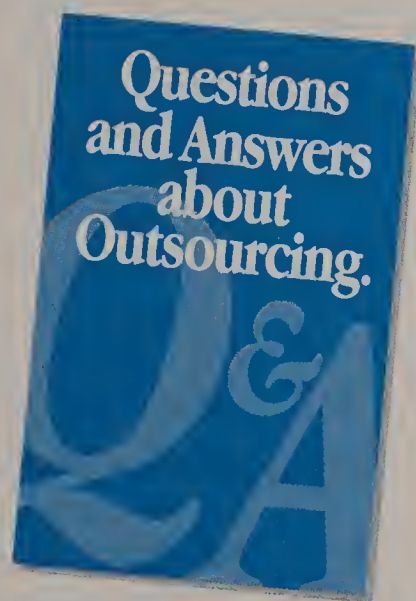
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TRENDLINES

BEYOND REMOTE CONTROL

The fanciful notion of the masses sitting at home using computers to do their banking, voting and shopping never became a reality. Though the technology exists, hardly anybody wanted to bother with modems and manuals. But the fanciful-notion makers are getting a second chance. Earlier this year, the Federal Communications Commission cleared the way for interactive television—two-way TV sets that can deliver interactive services into the home without the hassles and expense of computers and dial-up networks.

After a year's evaluation, the FCC reserved a segment of the radio frequency spectrum for Interactive Video and Data Services (IVDS) signals. The agency is expected to begin issuing IVDS licenses before the end of 1992, with the first services to reach consumers soon thereafter. Up until now, vendors of interactive TV services were prevented from using the airwaves for transmission.

The FCC action has opened the door for vendors like TV Answer of Reston, Va., which recently agreed to collaborate with Hewlett-Packard on developing the first national interactive system. (H-P will manufacture devices to control the system.) Under an experimental license, TV Answer has already conducted a two-year trial of interactive TV in Fairfax, Va. Participants used send/receive devices to respond to questions, rate music videos and participate in contests—all via their own idiot boxes. ■

USER INTERFACES

XEROX'S PAPER CAPER

The latest office-automation hardware from Xerox Corp. isn't hardware at all. It's paper. Plus a little software to smarten up the paper. The big thinkers at Xerox's Palo Alto Research Center (PARC; see "Minds Over Matter," Page 38; and Trendlines, *CIO*, December 1991) have come up with a genre of products that the company says constitutes the first paper/user interface—which it has dubbed PaperWare.

Xerox's first PaperWare product, introduced last month, is called PaperWorks. The PC-based software package combines fax and image technologies to enable users to trigger a variety of electronic information-filing and -distribution tasks from remote sites. By faxing coded paper forms to their own PCs, users can initiate "send," "retrieve," "store" and "delete" commands. In the upper right-hand corner of each form is a chicken-scratchy rectangle of binary coding that identifies the task and the user and invokes the appropriate software response on the receiving end.

In the PARC tradition, PaperWorks furthers the goal of "ubiquitous" connectivity. But the developers also see the product as a document-management tool for the PC. The way users organize distribution lists and information-filing categories on the PC end can enrich PaperWorks' usefulness as a remote-access interface, with users able to customize their forms based on their document-management needs.

Users can retrieve documents stored in their PCs

and have the documents faxed back to themselves as well as to others; they can fax documents acquired on the road to their home PCs, to be stored as electronic images and/or distributed elsewhere; they can get a current in-box list of their fax mail and retrieve any that they wish to read.



Any number of PaperWorks "jobs" can be stacked in a remote fax machine as long as each job is accompanied by the appropriate coded form. The forms are straightforward and intuitive. They are filled out in pencil or pen, and the software tolerates such variables as whether people prefer to make Xs, slashes or check marks.

There are single-purpose and multipurpose forms; the latter can trigger both send and retrieve actions—for example, they can fetch a document stored in the user's

computer and forward it to a designated recipient.

One more thing: If you happen to leave town and forget your PaperWare forms, just fax a blank piece of paper to your PC. In response, it will fax you a blank "starter form" that you can use to execute basic functions and request additional forms. ■

A NEW SOURCE OF REFERENCE

New Yorkers are accustomed to not getting a seat on the subway or for a hot Broadway show, but lately it's been standing-room-only in the reading room of the New York Public Library's Economic and Public Affairs division. That situation should change sometime in 1995, when the city's long-awaited Science, Industry and Business Library opens to the public.

Housed in 200,000 square feet of the landmark B Altman building, the SIBL will contain more than 2.5 million volumes originally belonging to the main library's science, industry and business holdings. Collections will cover such diverse subjects as advertising and astronomy, management and mathematics, finance and food science.

In addition to broad-based services for the general public, the new library will offer targeted services for corporations (such as document delivery and 24-hour online search capability), government agencies, small businesses and individual researchers. The SIBL is being promoted as a library without walls; users at remote sites can access its electronic databases through a 24-hour dial-in service.

The project is expected to cost \$80 million in public and private funds. Additional money could be raised by fining CEOs who insist on talking loudly in the stacks. ■



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TRENDLINES

TECHNOLOGY INITIATIVE

A JUMP START FOR COMMERCIAL R&D

The Bush administration rolled out the big guns when it launched the President's National Technology Initiative at the Massachusetts Institute of Technology on Feb. 12. The Initiative is essentially an accelerated technology-transfer program aimed at helping businesses make better commercial use of new technological advances, including those developed in federal laboratories. (The federal government funds half of all research and development underway in the United States.)

Energy Secretary James Watkins, Acting Commerce Secretary Rockwell Schnabel, Acting Transportation Secretary James Busey and NASA Administrator Richard Truly addressed a standing-room-only crowd on the virtues of the administration's scheme.

(A few hours later, Truly announced his resignation; it is widely believed that the president had fired the former astronaut and Navy vice admiral two days before his MIT appearance.)

In Cambridge, however, the canned manager was an articulate advocate of his boss's initiative. He noted that NASA has long been engaged in a public-private partnership with U.S. aircraft makers. In a bid to keep them competitive, the agency helps companies research control systems, materials and aerodynamics. (Shades of industrial policy, a Bush administration *bête noire*!) Other NASA projects have ended up in the marketplace, including an automated system that analyzes body fluids for evidence of certain diseases.

Truly told the audience of business leaders and academics that NASA has established six regional centers to open up its technology to industry. These centers offer local firms and industries computerized searches of federal technology databases, assessment of technology requirements and engineering reports, technology brokering, venture-capital sourcing and other services. The regional centers form the core of a national network that also includes federal, state and local agencies, federal laboratories and business and industry organizations.

The February conference was the first in a series of meetings designed to increase awareness of federal technology programs and promote discussion among members of government, industry and academia. ■

NAMING THE VICTIMS

Mass graves in such countries as Chile, Argentina and Iraq bear silent witness to the atrocities of repressive regimes. Now, with the help of computers, anthropologists are giving names to the anonymous dead and forcing governments to face a past they would rather forget.

Experts estimate that between 1973 and 1988, the Chilean authorities executed more than 2,000 people, mostly political prisoners, and hid the bodies in clandestine graves. A recent article in *The New York Times* reported on a team of forensic anthropologists who are trying to identify more than 100 skeletons exhumed from grave sites inside a large cemetery in Santiago. Some of the bodies, most of which had been shot, were hidden in already occupied graves, while others were buried in graves marked "N.N." for "no name."

To help them in their task, the scientists have developed computer programs for collecting evidence electronically, including one that analyzes bone measurements and other data to produce estimates of sex, age and other factors. For example, the program can distinguish among Caucasoid, Negroid and Mongoloid races by analyzing skull measurements. The group also uses its computers to store ballistic data from bullets found in the bodies, medical and dental records, anecdotes told by fellow prisoners and interviews with families and friends of victims that help round out the profile.

Impressed with their results, an American anthropologist hopes to take the Chilean group to Iraq, the *Times* reported. There it will help train Kurdish anthropologists seeking to identify the victims of executions by the Iraqi authorities. ■

A SOFTWARE PEOPLE METER

It seems like there is a PC software program designed to make every activity a little easier, whether it's preparing taxes or writing a will. The Employee Evaluator & Salary Manager 3.0 is aimed at making performance reviews and pay increases a matter of plugging in a few predetermined factors and letting the software calculate the fate of employees.

The LAN-based program from Hi Tech Enterprises in Monterey, Calif., is designed to streamline and standardize the employee-appraisal process. Employees are

evaluated based on factors over which they have control, such as attendance. Review decisions are based on scalable performance factors. Once an employee is

evaluated, the program recommends a pay raise based on the company budget.

While the software promises to eliminate budget overruns, overcompensation, subjective evaluations, salary/wage disputes, wasted time and lawsuits, it doesn't guarantee that disgruntled employees won't take out their frustrations on your network. ■



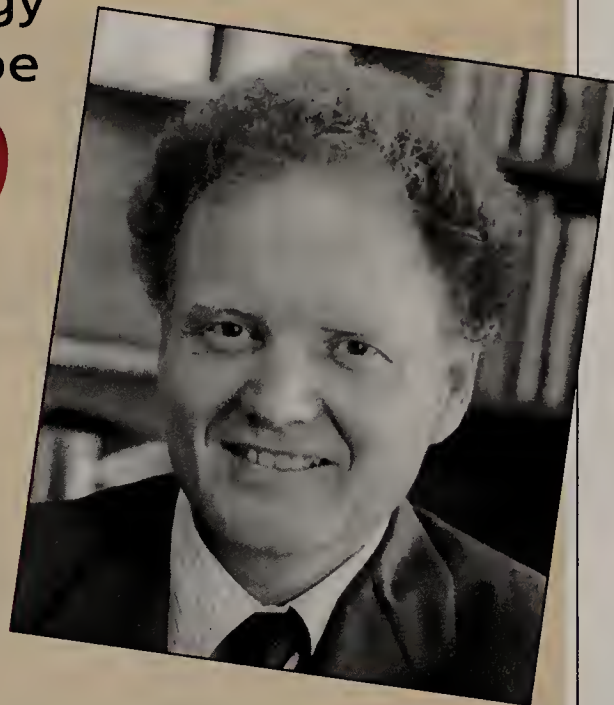
“America must adjust its industrial practices to conform to those of the rest of the world. . . . Our skills, our plants and equipment, our technology and our management abilities have to be better than the rest of the world’s.”

LESTER THUROW



“Uh-oh!”

ROBERT FULGHUM



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TRENDLINES

MODULAR SYSTEMS

A BLUEPRINT FOR THE FUTURE

The maxim that those who can't do, teach, doesn't apply at Apple Computer. The company's internal IS department has spent the last two years working with one of its suppliers, Digital Equipment Corp. of Maynard, Mass., and

key customers to build an architectural strategy that gives users the context for future enterprise systems and offers them models for building them. VITAL (Virtually Integrated Technical Architecture Lifecycle) is a platform-independent technical blueprint

NEAR-FUTURE SHOCK

Expect a false economic recovery in 1992, not a real one, says the Socio-Economic Research Institute, a trend-forecasting consultancy based in Rhinebeck, N.Y. Neither lower interest rates nor President Bush's "new action program" will pump up the economy's volume enough to prevent higher inflation and lower national savings this year.

The Institute's other predictions are equally dollar-minded. Brand loyalty will falter and generic products will flourish as consumers try harder to pinch pennies. Upscale labels will also suffer, while home sewing and crafts are already showing an upsurge. Repair services will prosper as consumers fix up appliances, cars and homes rather than buy new ones. And inexpensive state fairs will take business away from expensive theme parks, although most people won't be able to enjoy either, since increased workloads caused by staff reductions and the growing need to moonlight mean that workers will have less leisure time.

The Institute also predicts that union activity will heat up this year, as

workers band together—even in traditionally non-unionized service industries—to hold onto health-care benefits and pay levels. Evangelical religions will enjoy 1992, though: The Institute predicts that these churches will add social services like day care to their portfolios and gain new adherents, while the larger churches will still pretend that the world is composed of 1950s-style nuclear families. ■

that started as an unfunded skunkworks project among Apple's technical staff, according to Vice President of Information Systems and Technology Debi Coleman. The way Coleman describes it, Apple's technical staff, frustrated with the company's rapidly rising support costs, inconsistent standards and full-blown productivity crisis, began to create highly scalable modular systems to meet rapidly changing business needs.

Coleman made VITAL a priority when she became CIO two-and-a-half years ago, and since then VITAL has helped the IS group improve its telecom and computing services dramatically while minimizing support and maintenance costs.

The VITAL framework will enable IS organizations to

construct transparent, cost-effective, multivendor systems that provide easy user access to information across functions, accommodate rapid changes in business and technology, support a gradual migration to new systems, integrate installed technology and incorporate client/server technologies.

VITAL is not a set of products, but a vision for tying together interrelated logical environments via a robust systems infrastructure to add value to the network, according to the manager of Apple's Enterprise Systems division, Blake White.

In Coleman's eyes, VITAL is the result of the IS group's decision to stop being mere back-room processors and become full business partners in the company. ■

FAR-FUTURE SHOCK

The ever-changing role of the CIO will take a bizarre twist this decade, if one can believe the predictions of Eric Hughes, creator of the live-performance show "A Prairie Home Computer" and guru of Artificial Stupidity. Hughes sees IS managers evolving into taxi dispatchers, doling out data to the country's swelling officeless population. Evicted from their desks by pen-based computing and wireless networks, the officeless will tote bulging briefcases and loiter in airport coffee shops between assignments.

Coordinator of Boston's Parade of Tall Buildings Year 2000 Celebration, Hughes is a multimedia performance artist and market manager at Adaptive Networks Inc. in Cambridge, Mass. He offers these and other predictions for

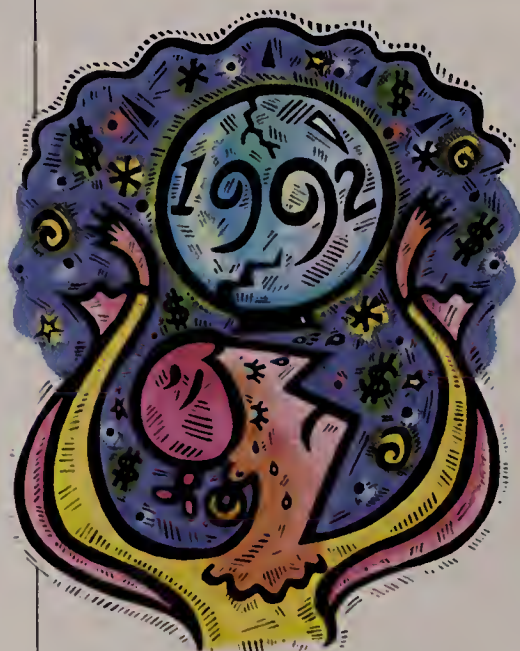
readers of *CIO*, which he prefers to call "Datastyles of the Rich and Famous."

► With technologies like EDI transcending company boundaries, CIOs will increasingly find themselves working for or over employees who don't work for their firms.

► Instead of Big Brother, information technology will give birth to millions of Little Brothers running around attacking personal privacy. Witness today's E-mail and eavesdropping on cellular phone calls.

► Promotional messages like those appearing on automated-teller screens will spread to the desktop. "Infomercials" will pop up on CRTs, pitching site licenses or consumer products like Visine and Anacin.

► In the world of the future, every 15 minutes will be famous. ■



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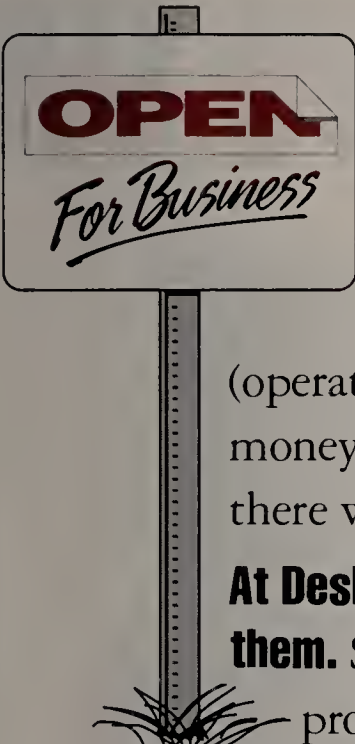
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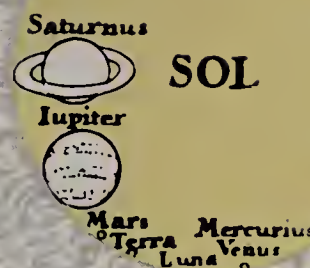
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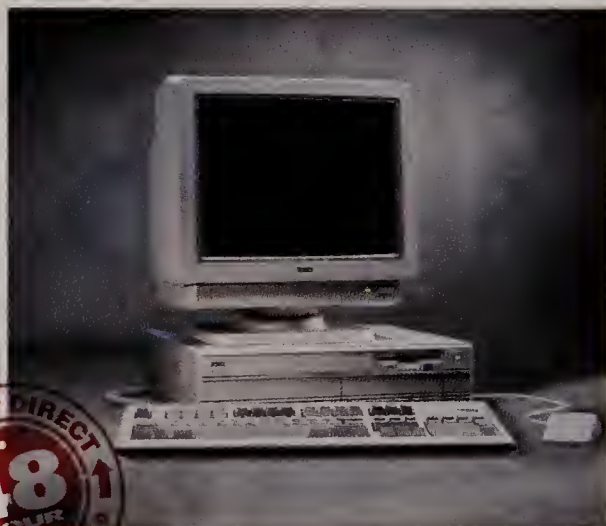


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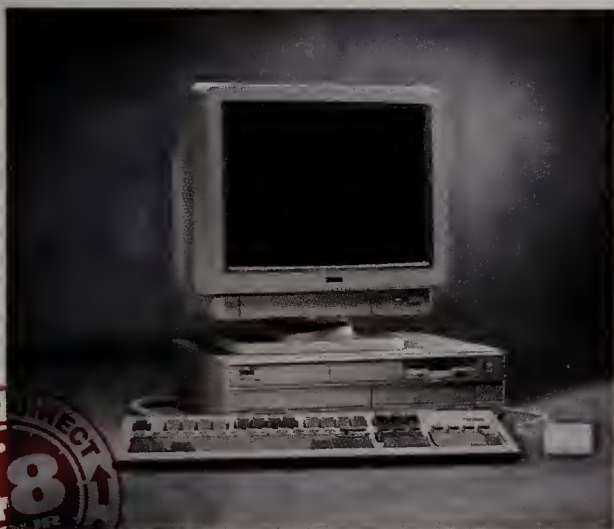


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Keyboard: 84-key
Mouse: Logitech™ TrackMan® Portable
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Customization Worksheet

Your base system is a: ☐ 286 ☐ 386 ☐ 486 ☐ Other

How many applications will your PC(s) run in a typical workday? _____

What best describes the type of work the system will be used for?
(Check all that apply)

- | | | |
|--|---|--|
| ☐ Word Processing | ☐ Desktop Publishing | ☐ Scientific Research |
| ☐ Order-entry | ☐ Education | ☐ Software Development |
| ☐ Database (filing records) | ☐ Design (CAD/CAM) | ☐ E-Mail |
| ☐ Financial Calculations | ☐ Engineering | ☐ Other industry-specific applications (please specify) |
| ☐ Retail Store Management | ☐ Industrial Process Control | |

How many people work in your group, department or small business?

- ☐ Less than 10 ☐ 10-20 ☐ 20-35 ☐ More

Is your operating system:

- ☐ DOS ☐ DOS with Windows ☐ OS/2 ☐ MAC ☐ UNIX™ ☐ Other

Which of the following graphics-oriented applications best describes your needs?
(Check all that apply)

- | | | |
|---|--|--|
| ☐ Desktop Publishing | ☐ Realtime Modeling | ☐ AutoCad |
| ☐ CAD/CAM | ☐ Animation | ☐ Business Graphics |
| | ☐ Image Processing | |

LAN Communication

How many PCs do you have installed? _____ From how many manufacturers? _____

What kinds of connections does your PC(s) require? (Check all that apply)

- ☐ Links with other PCs in the immediate surroundings
- ☐ Connection to the local area network (LAN) throughout a building
- ☐ A line to a host system in a remote location

What kind of media (cable) is used in your LANs today? _____

What is the networking software now being used in your company? _____

What kind of host system will your PC communicate with?

- ☐ DECpc ☐ IBM ☐ Other _____

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Sympathy for the Consultant

Meet the new, reengineered Tripp Strange! He's now a consultant giving bad advice and working like the devil....

BY TRIPP STRANGE

This column should probably be entitled "Return from Albania," or something comparably uplifting. After last year's debacle (thanks, by the way, for all the hate mail!), I finally got smart. If you can't fight the consultants, then by all means join them!

For the handful of *CIO* readers who are out of the Tripp Strange loop, I used to be CIO of Threshold Industries Inc., a Pensacola, Fla., manufacturer of waste-compaction hydraulics and microwave-transmission hardware. I had a perfectly beautiful life, unmarred by tawdry conflicts or demoralizing setbacks (see "O, Lucky Man," *CIO*, April 1989). Sadly, my bubble burst when I authorized the design of an admittedly useless system, subjected my company to nearly undetectable virus contamination, and was superseded by Threshold's moronic CFO, Teddy Hock, who moved me into an air-

less, windowless cubby off an out-of-the-way corridor occupied mostly by mice and silverfish, and frequented only by those on the way to someplace else—which I was clearly not. (See "Oops... My Luck Ran Out," *CIO*, April 1991.)

At this time last year, my title was "application development backlog manager," and my mental outlook was "suicidal." By June I had watched the lights go out on in-house IS. Nobody waved goodbye. Threshold's outsourcing vendor, the Tulsa-based computer-services subsidiary of a giant fast-food chain, promised jobs to all of my former employees. But they never said what kinds of jobs, and I swear I've seen some of them wearing dazed expressions and little blue paper hats while working the counters down at the local Burger Buster.

From June until September, my only human contact during a typical workday was with surly Danielle in the cafeteria. ("Cream cheese on your bagel?" she would snarl each morning. "No thank you," I would mumble in reply. And that would be that.) Teddy Hock sometimes stopped by my office to gloat. He would stand in the doorway and look perplexed, pretending that he'd arrived there quite by accident while searching for the telephone wiring closet. ("Oh, so THIS is where they've got you now," he would say, smiling blandly and seeming to be wrestling with the idea of speaking further to me—perhaps to offer insincerely to buy me lunch someday.)

Autumn is the season of decay, but in Florida it offers none of the usual pleasures. Yes, the days grow gradually shorter; yes, the breeze seems to stiffen slightly and the trunks of palm trees become a duskiest gray. But, no, you do not notice dramatic or colorful changes. And change



was what I needed.

For weeks on end I huddled in my forgotten warren with the door closed, dozing in the oxygen-poor atmosphere and wondering what to do next with my pitiful, cul-de-sac'd existence. Then, on Halloween, I did an unintentionally brilliant thing: I came to work dressed in an undertaker-blue suit across the back of which my wife had stitched white felt letters spelling out the word "CONSULTANT." Walking through the fourth-floor atrium on my way to steal candy corn out of the glass jar on the receptionist's desk, I heard a tender voice inviting me to lunch.

I went. The voice belonged to none other than famed consultant Cornell Downs, the pretentious fraud who had happily deconstructed IS at Threshold.

"I noticed the interesting group identification on your back," said Downs, playing with the stick in his pina colada. "I'm looking to hire a reengineer."

"A what?" I said. "I don't know what that is."

"A reengineer. You know—someone who goes in and changes everything and then leaves? I can charge a lot of money for providing a service like that. I can pay *you* a lot of the very same money I would charge for a service like that."

He smiled. I'm sure he didn't recognize me as the now-deposed emperor of the IS kingdom he'd so recently sacked.

"It's the nuts, this reengineering racket," he said. "Everyone wants to change everything. It's unbelievable. Gluttons for change. You'd think that homeostasis equaled death. Downsizing is small potatoes compared to reengineering.... But first I need to find me a reengineer."

"Well, then, I'm your man," I told him. "I can definitely change everything and leave. In fact, I'm looking for some change right now."

We shook hands over steaming plates of pompano almonidine. And so I came to spend all my days learning from Cornell Downs the secrets of turning a colossal profit by exploiting the weird momentum in favor of chang-

Why would a consultant direct his clients to undertake manifestly senseless projects?

ing everything. And leaving.

Some of the things I have changed:

■ I advised a well-known and fabulously profitable direct-mail marketing company to become a telemarketer and to relocate from Plano, Texas, to Minneapolis.

■ I advised an Ohio-based bank to outsource the operation of its lucrative and efficient payroll-processing division. "Why would they ever do such a thing?" I asked Cornell. With perfect confidence I told him they'd never agree to it. But he only laughed and bet me a percentage of my fee that they would. They did.

■ I advised a thriving urban bike-messenger service to invest in costly and cumbersome handheld computers that the messengers now must carry on their backs in complicated harnesses that limit the size and number of parcels they can deliver at one time.

Possibly these will strike readers as extraordinarily silly projects—as indeed they were. And yet it was scarcely a struggle to get management to accept the wisdom of going forward with them. I have a theory on why this is so. Advising them to do something sensible would have felt far too little like change. In the topsy-turvy world of reengineering, radicalism seems curiously safer than sanity. If you don't advise some major dismantling or incongruous reordering of things, your customers will distrust the value of the service you offer. Cornell was always clear on this point: "Don't sell them a bloody stepladder; sell them the Brooklyn Bridge."

Perhaps it has occurred to you—as it eventually occurred to me—

that Cornell Downs is the devil. How else to explain a consultancy apparently devoted to directing its clients to undertake manifestly senseless, self-destructive projects? Whenever I come up with a recommendation that I believe holds some promise of improving a company's business processes, Cornell (whose name, by the way, is an anagram for the satanic phrase "dwell on scorn") quibbles with it or fatally modifies it, or else completely shoots it down. In truth, I have no expectation that most or many of the companies we've reengineered will still be in business by Labor Day.

However, when I confront Cornell with the probability that he is sowing the seeds of his customers' doom, he breezily brushes aside my qualms. "Tripp," he reminds me, "I'm a businessman. I'm in business to make a profit. And I'm giving my customers what they want. Have you ever heard anyone complain? Is anyone *dissatisfied*?"

And he's got a point. No one *has* ever complained. Of course, they are all still struggling gamely up the learning curve—exhilarated by the recipe, drunk on beguiling promises, bravely staring down the unpleasant necessities of closing departments, moving their headquarters, laying people off and spending buckets of money to retrain the people who aren't being laid off.

Are we talking genuine evil here? Or does this all come down to a failure to own the decision-making process? I mean, aren't the people who follow bad advice ultimately responsible for their own flawed judgment? As Mom Strange used to tell me when I was a boy: "Just because Nicky Peyser says jump in the quarry, that doesn't mean you have to do it."

Aren't Cornell Downs and I just a couple of Nicky Peysers? And so, when we come to your company, shouldn't you really think twice about what we tell you to do? ☐

April Fools! Tripp Strange is an imaginary reengineer with the Cornell Downs Group, a fictitious consulting firm based in Seventh Circle, Kan.



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The Virtuous Virus

The conventional wisdom is that the only good virus is a dead one. Not everyone agrees.

BY FRED COHEN

In the September/October 1991 issue of The Sciences magazine, Fred Cohen, who coined the term "computer virus" in 1983, wrote that "the features that make computer viruses a serious threat to computer integrity can also make them a powerful mechanism for the reliable and efficient distribution of computing resources." The following is an excerpt of that article.

In most of the world's computers, the time spent idling or waiting for further instructions far exceeds the time spent processing. Indeed, making optimum use of processing resources is extremely hard to do; large machines with many processors working in parallel on a given problem often have more difficulty optimally distributing the workload to the various processors than they have solving the problem itself.

Computer viruses offer a mechanism for efficiently distributing the processing and thereby putting wasted capacity to work. If the early viruses developed for practical purposes had been error-free, then

reliable, high-speed software incorporating viruses for

many applications might now be available. One example of useful viruslike software is the Lenstra-Manasse creature, which finds the factors of large numbers by combining the efforts of many computers in major international research networks.

The creature avoids propagating in an unwell-

coming environment by getting permission from computer owners through electronic mail before it uses a computer's free time. Each segment of the program reports its results back to a central location via electronic mail, and the central computer then distributes new, evolved pieces of the problem.

Although the Lenstra-Manasse creature has hardly broken any records for parallel processing, it does work faster than any single machine. It is also highly reliable; if one computer does not return an answer within a certain time, the program segment is sent to another computer. The creature could not succeed, however, if its computing environment were not made up of many cooperative people who have given permission for it to operate.

Another useful virus is an automated bill collector, which I developed for two custom-designed computing environments running under the Unix operating system. In the first environment, the virus helps a small business follow up on thousands of orders of only a few hundred dollars each. In the second environment, the virus helps a law office specializing in the collection of unpaid commercial loans to keep track of its work for thousands of clients involving tens of thousands of debtors.

For the law office, the computing environment "gives birth" to a new "bill collector" every time a new case is taken on, and it "kills" the collector as soon as the bill is paid. In its simplest form, each bill collector virus is a small program designed to collect one bill; the collector sends a series of letters to the debtor and evolves by modifying itself according to the debtor's response. The average programmer could write such a program in a few hours, on the basis of the methods



of expert human bill collectors.

Most high-volume bill collecting today is carried out by software in which a small bill-collecting program, such as the one just described, interacts with a large database of cases. The small program must be altered for each set of circumstances, and another program must scan the database periodically to determine which cases require action. To collect other data such as statistical information, new scanning programs have to be written. The result is large and cumbersome machinery, in which the original program for collecting the bills is only a minor cog.

To design a program that takes advantage of a virus, on the other hand, one pursues a different tack. Instead of creating a large centralized bureaucracy for controlling and directing all the activities, one distributes all the functions to the individual bill collectors. Each collector gets only

provide only for replication, evolution and wake-up calls; there is no need to deal with the complexities imposed by a large database. Furthermore, the use of many small programs instead of one large one allows the workload to be spread over many computers. It also eliminates any need to worry about the subtle errors that can crop up when processing, and data entry can take place in more than one place at the same time.

There are disadvantages, however. When the bill collecting is done by a single computer, viruses are less efficient than a database. Their independence also makes it difficult to change all the bill collectors at once; each one must be wakened and told to change its program. But most such changes can be made in new bill collectors only, and so the changes spread gradually throughout the system as old bill collectors die off.

The computing environment "gives birth" to a new "bill collector" every time a new case is taken on, and it "kills" the collector as soon as the bill is paid.

the information related to its own case. Instead of scanning a database for bills to be collected, each collector takes whatever action is appropriate for its case, then schedules a "wake-up call" that tells it when next to take action and goes back to "sleep." In the meantime, if a payment or some other response comes in, a human operator can send an earlier wake-up call to the appropriate bill collector. The collector evolves so that it can react properly to each situation. If statistics are needed, the humans simply wake up all the bill collectors during off-hours and poll them for the information.

The clear advantage of the virus approach is that each program need

In 1986 I wrote the first viral bill collector and had it operating in one week. It has evolved in response to changing circumstances without any need for global changes; on the contrary, all the changes have entered the system through new bill collectors, which require a minimal programming effort to create.

The computing environment in which the bill collectors live also hosts a colony of maintenance viruses. They are perhaps the most useful class of computer viruses in existence today. They waken periodically to clean up the system; for example, they can dispose of undeleted temporary files, stop programs stuck in infinite processing loops and ad-

just incorrectly set protection bits, which tell the operating system whether a user is allowed access to a file or not. As such problems accumulate on a computer system, processing becomes increasingly difficult until finally a systems manager has to clean them up. The maintenance viruses on the bill collector system were so successful that they even eliminated problems caused by other failed maintenance viruses. Eventually, the system operated for two years with no human intervention except the adding and removing of users.

One of the most important features of a virus system is the mechanism provided for virus birth, death and evolution. Indeed, it is the particulars of the birth-and-death process that determine whether viruses run amuck and how they evolve. If viruses did not die, they would grow without bound; and if they were not born or newly introduced from time to time, all modifications would have to be made globally. In my bill collector system, for example, each maintenance virus is assigned a reproductive probability and a limited life span to keep the population under control. When the probabilities are adjusted properly, the viral population becomes stable yet resilient. Birth and death are particularly vital to optimizing viral populations when the environment can change dramatically.

The same is true of biological organisms in dynamic environments. People in the changing environment on land have limited life spans, whereas corals in the relatively static environment of the ocean live indefinitely, without noticeable aging. In a rapidly changing environment, stagnant strains that do not undergo birth and death eventually meet a threat they cannot overcome, and the species becomes extinct.

Still, many people do not see how the properties of evolution for biological organisms can be entirely carried over to computer entities. Cer-





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tainly reprogramming is easy to understand as a kind of evolution, but that is only one limited way programs are able to evolve. A basic evolutionary strategy is to ensure that the virus earning the highest profits from bill collecting is rewarded with the highest replication probabilities. To introduce collection tactics not already represented in a population of viruses, the weighting of various tactics can be varied randomly by the computer to generate new viruses.

A number of combinations of tactics may work well. If the weightings within the combinations are varied only slightly, profits may rise until a "local optimum" is reached. As time passes, some species may thrive while others may become extinct. As the environment changes, one species of virus or another may gain the upper hand; thus, life ebbs and flows. Such an evolutionary process, commonly called "random variation and selective survival," is equivalent to biological evolution.

Although the overall behavior of the viral environment is complex, the programs themselves are quite simple. Viral bill collectors can be written down with only a few pages of program code, and evolution has been simulated in experimental systems with only a few lines of code. Those lines are made up of a small generating set of instructions for guiding processes such as birth, death and random variation. It turns out that even simple generating sets can give rise to exceedingly complex systems.

In most cases, it is difficult or even impossible to predict the outcome of a given generating set. In fact, it has been proved mathematically that most of what one would call interesting about complex systems is unpredictable. The proof is based on the 1936 work of the mathematician Alan M. Turing, who showed that on a general-purpose computer, it is not always possible to foretell whether computer programs will ever finish processing. This so-called halting problem is one of the fun-

damental unsolvable problems of computer science. In 1985, I proved further that a virus can evolve in as general a way as a computer can compute. Consequently, the behavior of evolved viral populations can be just as complex as Turing's com-

Usually, as in the case of the maintenance virus, indirect communication is enough. The effect of maintenance viruses on the environment alters the actions of other maintenance viruses. For example, a virus that sets out to delete temporary

One of the most important features of a virus system is the mechanism provided for virus birth, death and evolution. Indeed, it is the particulars of the birth-and-death process that determine whether viruses run amuck and how they evolve.

puter—and just as unpredictable.

That unpredictability may unsettle many people who envision uncontrollable viruses wreaking havoc on the world's computer systems. But just as there are large classes of computer programs with predictable behavior, there are also large classes of evolutionary computing environments with predictable behavior. If computer programs are generated from a set of rules or specifications, for example, they can sometimes be guaranteed to act within predefined limits. Similarly, it seems, viruses could be restricted to certain behaviors if they were forced to conform to specifications. No one yet knows enough about viruses, however, to make accurate predictions about their behavior from a given set of restrictions.

One way of getting better control of viral behavior is through communication. Deaf and dumb viruses have a hard time surviving, because without controlling influences, they either consume too many resources and ruin the ecology or die out from insufficient population. Even rudimentary communications increase the chances for survival. Too much communication, on the other hand, promotes inefficiency by forcing the virus to process useless information.

files that have not been accessed in the preceding 24 hours will not delete files that have already been deleted by another virus. Since one virus acts differently because of the actions of another, there is a rudimentary form of communication between the two via the environment, and that makes their actions more efficient. In the same way, by generating sound waves, people change their environment in a manner that can be perceived by other people.

The possibilities for practical viruses are unbounded. Unfortunately, though, the plethora of malicious and unauthorized species in the world has given viruses a bad name. If the computing community does not take action to counter such intrusions soon, society may restrict all research on viruses, destroying any chance of exploiting their benefits. ☐

Fred Cohen is an independent researcher living in Pittsburgh and the author of A Short Course on Computer Viruses.

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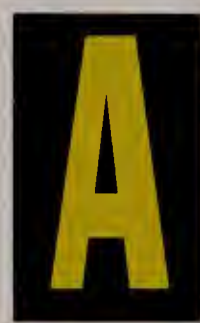


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TEAM BOOSTERS

As manufacturing enterprises reorganize into cross-functional teams, CIOs scramble to provide technology tools that will support the new order

BY ALLAN E. ALTER



S PRESIDENT OF TITEFLEX CORP.,

Jon Simpson reorganized his firm, a mid-sized manufacturer of high-pressure hoses and hose connectors in Springfield, Mass., into cross-functional, product-oriented teams. He also chucked Titeflex's old manufacturing control systems. "The rallying cry here was simplify, simplify, simplify—then automate," said Simpson, who has since moved on to a new position with parent company TI Group in Washington. Now it's automation time, and the firm is grappling with a new question: how to use systems "to make teamwork work better."

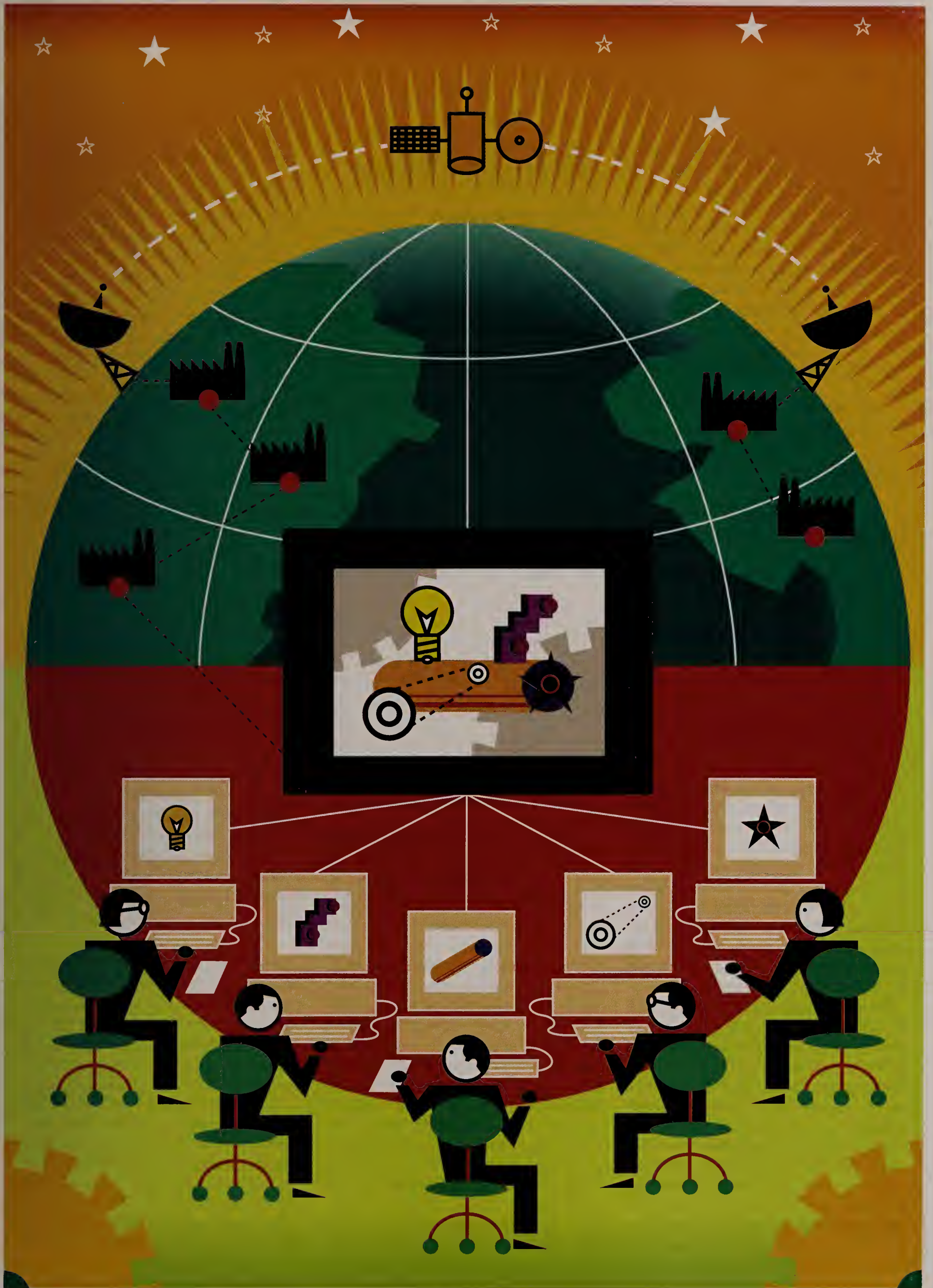


ILLUSTRATION BY DAVID FLAHERTY

Many other manufacturers are struggling with this question too. Teams, not traditional functions, are now widely acknowledged to be the best way to organize manufacturing enterprises. As David M. Dilts, a professor of management sciences at the University of Waterloo in Ontario, discovered in his recent study

These teams must communicate, coordinate and make decisions while spanning departmental boundaries, and often geographic and corporate ones.

of best manufacturing practices, teams are the common denominator of success.

These teams must communicate, coordinate and make decisions while spanning departmental boundaries, and often geographic and corporate ones. "Work has become so complex that nothing could be more helpful to a team than being supported by good technology," said Jessica Lipnack, president of the Networking Institute in West Newton, Mass., a work-process consultancy.

The good news, according to Lee Wylie, vice president and director of the Gartner Group's CIM practice in Stamford, Conn., is that the underlying technologies required to support teams—such as networks, databases and computer-aided design (CAD)—are now available. The bad news, according to Wylie and other observers, is that the applications are new, the caveats are numerous (see related story, Page 40), and the concepts involved are novel and unfamiliar.

Michael Schrage, business colum-

Minds Over Matter

.....
Group-support technologies should adapt themselves to people's mental processes, not reinforce existing organizational structures

At Xerox Corp.'s Palo Alto Research Center (PARC), the joke goes that the greatest advance in office technology in the 20th century is not the computer; it's the Post-It note. On a par with other office technologies, paper is held in high regard at PARC. A cynic might be tempted to think that this is only because of all the money Xerox has made turning paper originals into paper duplicates. But paper is above all else a friendly, adaptable, ubiquitous tool, and people have shown absolutely no inclination to abandon it.

The flexible, adaptable ubiquity of paper is exactly what's needed in any good team-supporting technology, according to Z Smith, a mem-

ber of the research staff at PARC—a place where serious thought is given to the ways in which people interact productively, and where the best technologies are the ones that are least intrusive (see *Trendlines*, CIO, December 1991).

"We need sets of tools that allow people to manipulate information from anywhere at any time," said Smith. He gives the example of four aerospace engineers holding a screen-based "conversation" about an engineering design. The four engineers, each in different locations, see the design on wall-mounted electronic whiteboards. As the engineers annotate the shared design on their respective whiteboards, the added commentary becomes immediately visible to the others, producing a real-time interaction that is also spontaneous and informal.

Conventional workgroup technologies, said Smith, are generally both nonconcurrent and highly formal. "Lots of the stuff that calls itself groupware is really 'organizationware,'" he said, meaning that it mostly regulates, schedules and tracks the flow of work from one group member to the next. "In the field it's sometimes referred to as 'Naziware.' Information technology shouldn't be used as a bullying mechanism, but as a way to untap potential in group interaction."

nist and visiting scientist at MIT's Center for Coordination Science, even thinks a new gestalt is in order. CIOs must go beyond the idea of sharing data over a network. "Successful collaborative technologies create a shared space," said Schrage, author of *Shared Minds: The New Technologies of Collaboration*. This shared space provides collaborators with "a model ... to interact around, add value to and augment. The real value of these technologies is not in the management of information, but in the relationships they make possible—using technology to create dialogue and interaction."

How far have CIOs and vendors progressed? "People are using the technology to help the teams, but we're just learning how to do it," said Woody Noxon, director of the Engineering Systems Division of Eastman Kodak Co. in Rochester, N.Y.

Consider something as fundamental as communicating. Voice and electronic mail are OK for brief one-to-one discussions, one-to-others messaging, and sending documents. But teams require more: Members need to hold discussions with many people at once, route information in a particular way, prioritize incoming messages, work together on docu-

Group-support technologies, he said, should fit themselves to the way the human mind works—in effect adopting the principles of ergonomics, only for the mind.

"We have a team of anthropologists [at PARC] who study how groups use tools," said Smith. The anthropologists have found that "you can't design the work process." People freely adapt it based on the tools that they are surrounded with. The way people use tools—as well as the choice of tools they favor—is highly conditional, depending on their personal styles.

"What's difficult about designing tools for groupwork is that the tools have to take account of the fact that the different people in the group have different styles that are essential to getting their work done." Thus, said Smith, "tools must be designed for adaptability [and] informality."

In keeping with its struggle against intrusive technology, PARC envisions future workplaces in which barriers between the physical and computational worlds virtually vanish amid "thousands of communicating objects" that are seamlessly available to workers.

"Computers will in a sense become invisible," said Smith, "in the same sense that electric motors are all around us and we never think of them."
—Lew McCreary

ments and arrange schedules. "Groups use E-mail, but E-mail does not have a group focus," said Susanna Oppen, an Alford, Mass., groupware consultant and coauthor of *Technology for Teams: Enhancing Productivity In Networked Organizations*.

Groupware—software designed to expedite the flow of information within a group—may one day provide that focus (see "Teamwork Tools," *CIO*, Nov. 1, 1991). Various groupware products, such as Lotus Notes or the Coordinator from DaVinci Systems in Raleigh, N.C., can handle many of these group chores. But so far, groupware is an office phenomenon

for early adopters. Manufacturing software and groupware experts know of no groupware products that have struck a chord among manufacturers and engineers.

There are some early groupware-like products geared to manufacturing, however: Hewlett-Packard's Shared X helps engineers at different sites work on the same document simultaneously. Another is CFM/Pro, a project-management software package with E-mail capabilities from TSG Inc., a Bedford, Mass., start-up.

Electronic bulletin boards are now used by some manufacturers. Team members post documents and topics for discussion; others add their comments and suggestions. But locating individual responses and tracking changes and earlier drafts can be difficult.

Computer conferencing systems may overcome these limitations. Products like Digital's VAXNotes and Caucus, from Metasystems Design Group Inc. in Arlington, Va., set up topics for discussion, and both record and track responses. This allows team members to easily locate earlier responses and drafts, get feedback to their queries, and track what other conferees have seen or written.

Teams need to meet as well as talk. In the manufacturing world, engineers working on the same product may work at different sites in different cities or even on different continents. Getting together can mean a trip across an ocean rather than a trip across the hall.

Videoconferencing is sufficiently advanced and inexpensive to be used as a medium for face-to-face meetings (Picturetel Corp. of Peabody, Mass., now sells systems for as low as \$20,000). "I've seen three different clients who installed video teleconferencing in the last quarter of 1991," said G. Terry Ross, an Austin, Texas-based vice president with Cleveland Consulting Associates who advises process manufacturers. Ross's clients like videoconferencing not only because it saves the time and cost of travel, he said; it also permits

them to do something they couldn't do before—hold regular, short meetings involving many people. As a result, they are more productive.

Holding meetings electronically via videoconferencing is one thing; using systems to make meetings more

Manufacturing teams must be able to manage and optimize the incredibly intricate flow of data that typically goes on within manufacturing organizations.

productive is another. Bringing printouts or slides to a meeting is as far as "computer-enhanced meetings" usually go. Some organizations, like Westinghouse's Electronic Systems Group in Baltimore, use PCs connected to an overhead projector in their meetings, said Patricia R. Fallon, manager of systems planning and database administration for the group.

Bernard DeKoven, director of the Institute for Better Meetings in Palo Alto, Calif., has taken screen sharing further with a technique for improving meeting productivity called "technography." In most meetings, said DeKoven, "you make lists, organize them and create priorities." In a technography session, groups run software on a PC with a projected screen to do just that. A trained "technographer" operates the computer, switching among software packages or turning off the computer when appropriate. Such sessions typically use off-the-shelf outliners, spreadsheets, word processors and workflow-diagramming software. Some packages combine applications; for instance, DeKoven uses Fair Wit-

ness from Chena Software in Allentown, Pa., which combines outlining with Gantt-chart creation; Symantec's More, an outlining package with word processing and presentation tools; and Microsoft's Word, among others.

Ventana Corp. in Tucson, Ariz., has come up with another approach. The company created a product called GroupSystems (also sold by IBM as TeamFocus), which requires an electronic meeting room: a room containing individual workstations networked to one another and to an

additional monitor visible to all. A meeting manager, using Ventana's software, guides participants through the process of brainstorming, analysis and decision making. Jay Nunamaker, chairman of Ventana, claimed that IBM and Boeing have found the system can cut individual meeting times in half and reduce the overall time spent in meetings during the life of a project by 80 percent. The cost of setting up an electronic meeting room ranges from \$80,000 to \$400,000, depending on the amount of hardware needed.

What distinguishes manufacturers from service and public-sector organizations is the business of designing goods, tooling up for production and manufacturing products. In order to work together, manufacturing teams must be able to share models of tangible products and industrial processes. They must also be able to manage and optimize the incredibly intricate flow of data that typically goes on within manufacturing organizations. Industry sources report progress in the prototyping, planning and product-data-management areas.

Product-data management—routing accurate, clear and current information and instructions across engineering and manufacturing functions—is one of two major problems that bedevil manufacturers. The other is a subset: configuration management. This is the art of ensuring that everyone is working with current data and drafts by tracking revisions, releasing approved drafts and storing earlier versions. These tasks are especially important for concurrent engineering, where teams of engineers from many functions may work simultaneously (see related story, Page 42).

Some vendors now offer software for product-data and configuration management. One of the more mature systems, according to James C. Jones, chief consultant for information systems at Hughes Aircraft Corp. in Los Angeles, is offered by Sherpa Corp. in San Jose, Calif. Hughes uses Sherpa's Design Management System to route data flows among departments, even when they use different hardware and operating systems.

In 1985, CIMLINC Inc. of Itasca, Ill., provided a paperless way to create and track engineering documentation and work instructions, and to transmit them to the factory floor. Its new product, LINKAGE, adds full motion and sound. It also enables floor supervisors to electronically mark up instructions with which they disagree and to send them back with an explanation of why they won't work.

Proceed with Caution

CIOs who foist teamwork tools on their companies could be making a career-limiting move, especially in businesses that aren't committed to the team concept and overcoming the organizational problems it can create. Before taking the plunge, CIOs should consider the following:

- **Organizational change must come first.** Tools cannot create a culture of trust and teamwork; only organizational change can do that.
- **Systems don't make decisions—people do.** The technology facilitates and supports the goals of the organization, but only the team can decide what those goals should be.
- **An agreed-upon approach to teamwork is critical.** The philosophies and methods need to be embedded long before the technology is put into place.
- **IS must be accepted as a partner by the manufacturing side.** IS is often excluded from manufacturing and engineering operations by line management, except to implement decisions.
- **Manufacturing managers can be skeptical.** Hying information systems can arouse the hostility of manufacturers who have been oversold on technology before.
- **Users must feel systems are owned by them, not imposed on them.** It helps if the tools are flexible enough so the team can modify them to fit the way it works best.
- **Technology can change team dynamics.** Syndicated columnist Michael Schrage quoted Marshall McLuhan: "First we shape our tools, then our tools shape us." At Kodak, providing information management tools for product design expanded the membership of the team.
- **A technical solution isn't always the best solution.** "I still think very highly of a flip chart and a magic marker," said Jessica Lipnack, president of the Networking Institute in West Newton, Mass.

—A. Alter

"AN
ARCHITECTURE
OF POSSIBILITIES
IS ROOTED IN
THE CONSTANT
OF CHANGE"

Richard Rogers,
Architect

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There's another way to make product design group-friendly: create computer-generated three-dimensional prototypes that help non-engineers on the team envision the product being designed. This can be achieved with modeling and simulation programs that create superrealistic drawings and animation, as is done at Kodak.

3M, based in St. Paul, Minn., creates wax models using stereo-lithography, one of several techniques for using CAD data to create a physical model. "A model you can hold in your hand can be more effective than a computer model, because manufacturing people often have trouble reading drawings," said Steve Wolfe, publisher of *The CAD Report* newsletter in San Diego.

But before there can be CAD drawings, prototypes and data to manage, a more basic issue must be addressed: how to organize and manage the product-development process. According to some teamwork experts, project-management software can help set schedules, show which manufacturing functions need to participate in a project, and delineate cross-functional relationships. "This kind of software, running on networks, is becoming the glue to make sure people make commitments and hold to the commitments they make," said author Schrage. T.J. Rodgers, founder and CEO of Cypress Semiconductor, uses this approach—although he adapted his own project-management techniques rather than rely on an off-the-shelf solution (see "Small Wonders," *CIO*, July 1989).

While there is plenty of software on the market that can sketch PERT networks, Gantt charts and other project-plotting diagrams, Jeff Stamps, cofounder of the Networking Institute, was especially impressed by TSG's CFM/Pro. According to Stamps,

Kodak:

Team Engineering

While building the Fling disposable camera in 1987, the Eastman Kodak Co. in Rochester, N.Y., came up with an approach to configuration management (tracking revisions, releasing approved drafts and storing earlier versions to ensure that everyone is working with current data) that it still uses today.

The Fling team set up a common engineering database, then assigned clear responsibility for each part and "assembly" (a collection of parts) to an engineer, said Woody Noxon, director of the Engineering Systems Division. "Other people could suggest changes to a part or assembly file, but only the person who was responsible for making changes could do so."

Team members notified each other of suggestions by voice- or E-mail. The agreed-upon changes were downloaded each night to the database, so each morning all team members had a fresh, up-to-date draft to work with. The result—the Fling camera—set two Kodak manufacturing records: speed to market, and fewest engineering changes required once in production. (Noxon declined to name the specific software Kodak used.)

—A. Alter

CFM/Pro establishes the cross-functional relationships required in each step of the manufacturing and design process, tracks the tasks required and the people who must be involved, and helps route E-mail and data among these ad-hoc teams-within-teams.

Another approach to managing the product-development process parallels the world of CASE and systems development. It begins with the creation of a data dictionary, to make sure everyone means the same thing by a "build package" and includes the same information in a "tool order." It continues by adapting a ba-

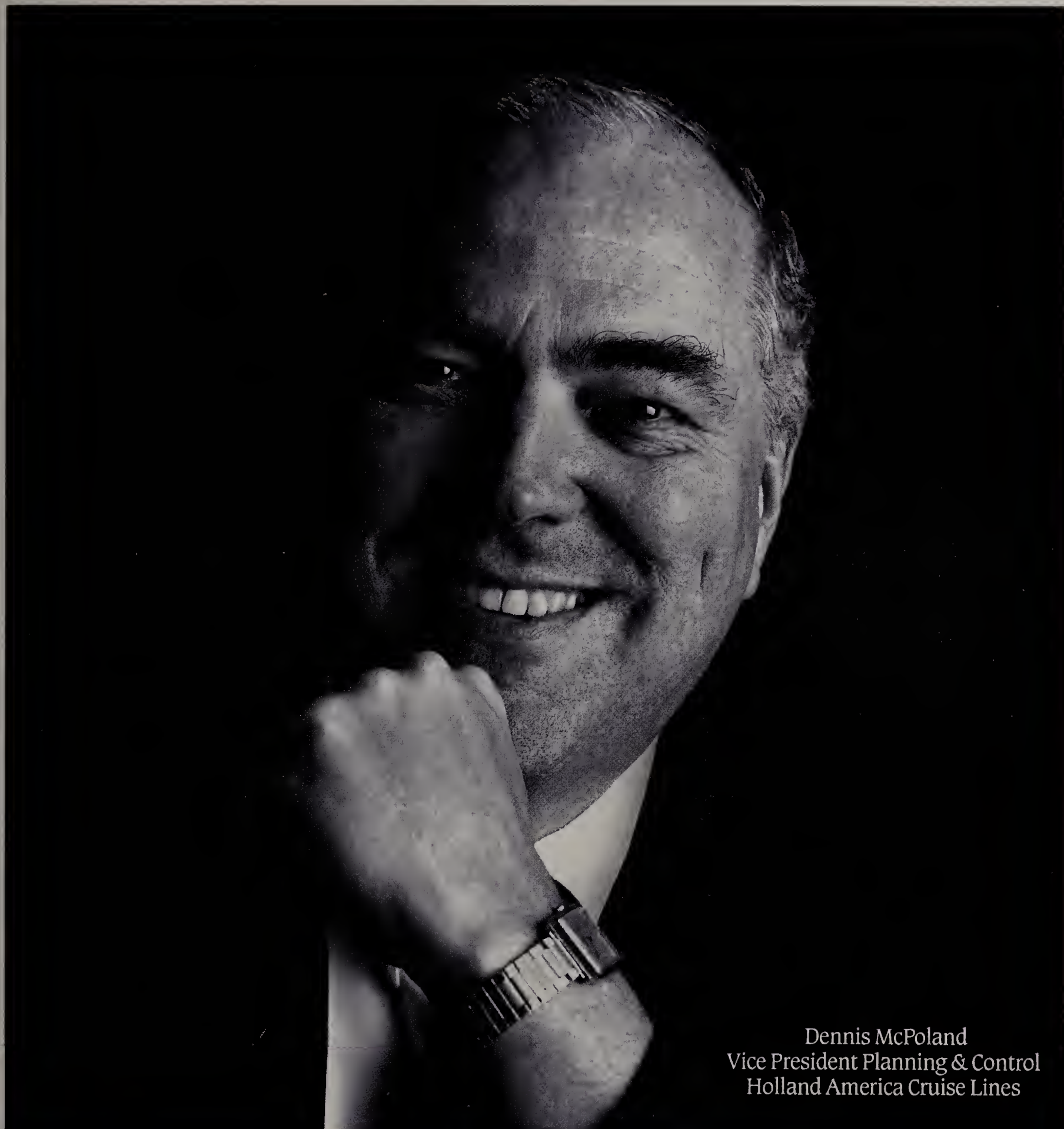
sic concept in software development in which developers carefully describe the business process and note its information requirements, then design systems that meet them. Finally, it uses design tools to sketch how the system flows.

Such large manufacturers as LTV Aircraft, Hughes Aircraft and Westinghouse are taking this path. According to Jones, Hughes Aircraft is beginning to create an enterprisewide product-data-management system. "We're trying to get onto a common semantic base," he said. "We're trying to define all of our processes across the company in a systematic way. We're doing very infrastructure-ish things so teams can be facilitated in the future."

Steve Cook, manager of IT enterprise planning and development at LTV Aircraft Division in Dallas, is in the thick of a similar effort. While the IS department is undertaking a "classic enterprise-level business analysis," LTV is following a total-quality program it calls the "Integrated Process Management Methodology." As the IPMM teams examine LTV's business processes, IS is "capturing that information and putting it into our data dictionary," which

runs on an Oracle database, said Cook. This data will help them build the company's "information strategy."

Product-data-management systems . . . stereo-lithography . . . electronic meeting rooms—a lot of experimenting is going on. However, "up to now, these individual tools have been difficult to bring together with one scheme," said Gartner's Wylie. Nor are any—with the possible exception of videoconferencing—generally "big and robust" enough to bet the ranch on. Manufacturers will have to decide whether to wait for the technology to become mature or begin to experiment now. ☐



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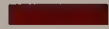
BY RICHARD PASTORE

CAST A STONE INTO A POND and the expanding ripples may stir a floating leaf or jostle a frog or two, but the pond is essentially unchanged. Cast image processing into the corporate waters, and the effects are potentially far more profound. The paper-handling process will change, and this change will in turn create ripples that alter the structure of departments, reverse trends in duty segregation and smudge the dividing line between managers and operators.

Perhaps imaging's greatest strength springs from the change it can bring to the basic workflow process. With paper documents automatically scanned or even faxed into the image system, error-prone data entry becomes as obsolete as punched cards. A document no longer has to snake its way from one department to another, suffering the delays and overhead costs built into its circuitous route. In electronic form, documents are available for access by several workers at once. Logging, routing, auditing, monitoring and sign-off procedures all can be either eliminated or automated using sophisticated image-workflow tools (see related story, Page 48).

With all these process changes possible, it's startling that most users have been content to employ imaging

Using image technology to get rid of paper turns out to be a merely cosmetic change. The real impact of imaging comes from the workplace.





JAN SCITES has seen productivity gains of more than 35 percent since imaging gave underwriters at Connecticut Mutual Life more authority to make policy-approval decisions.

Life. "We now report [management data] weekly and monthly, but we'll be using more daily statistics gleaned from the image system to do our forecasting," Murphy said. The firm so far has converted all maintenance transactions, adjustments and telephone records to an image system supplied by DST Systems Inc. of Kansas City, Mo.

Employee specialization and segregation, hitherto accepted trends in the workplace, are being reversed in some cases by image reengineering. Automated omission-checking and electronic "paper-clipping" features of some image systems help ensure that documents and supporting material are accurate and complete. This

means that exceptional or problem cases crop up less often—requiring fewer specialized-skill workers to deal with them.

Such was the situation at Bank of Boston, where less-than-ideal paper-handling methods necessitated that specialists handle problem cases. "Because processes are more structured and the information is better documented [using imaging], the amount of exceptional cases has diminished," said Arthur Flavin, systems consultant at Bank of Boston headquarters. The bank installed its IBM ImagePlus workflow system two years ago.

In many companies, documents are shuttled from worker to worker on

How to Reengineer Workflow for Image

- ▶ Obtain senior management commitment to both the technology and to change.
- ▶ Meet with affected department heads to discuss ultimate objectives of image and reengineering.
- ▶ Study existing paper workflow from its origination, including all personnel contact.
- ▶ Look for weak points and calculate costs of delays, overhead.
- ▶ Design new workflow, incorporating image and workflow software capabilities. Calculate system cost versus expected savings from streamlined workflow, productivity gains.
- ▶ Implement a pilot system in one high-visibility department or one category of documents.
- ▶ Reevaluate, redesign workflow if necessary.
- ▶ Implement full-scale program.

Source: Avedon Associates Inc., Potomac, Md.



SARAH MURPHY: "We'll be using more daily statistics gleaned from the image system to do our forecasting."

the same level, with each focusing on only one part of a multistep process. Image reengineering can purge this kind of duty compartmentalization from the process. "What we've done with imaging is put more information in people's hands and given them the ability to do more of the work," said Charles Plesums, senior director of systems architecture at USAA, a San Antonio, Texas, insurer and one of the largest image sites in the world. For a typical policy, one worker can handle the entire preparation process, he said. The payback comes from improved quality, since the employee now "owns" more of the work and is

PHOTO BY WEBB CHAPPELL

more accountable for it.

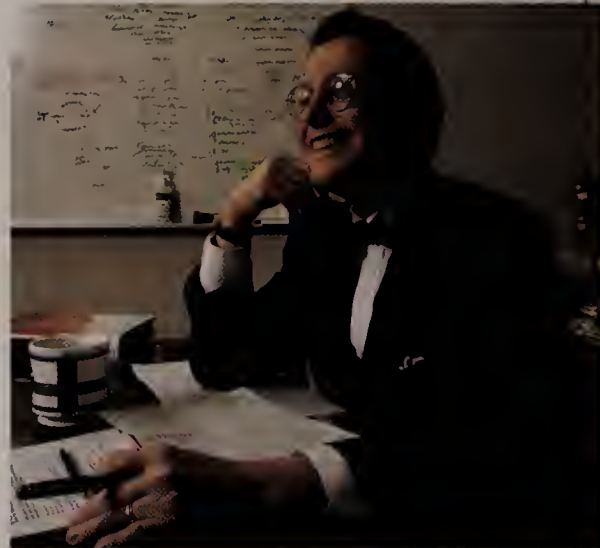
As it reverses compartmentalization, image reengineering can also dissolve divisions between departments. Since accurate, updated versions of paper documents cannot exist in more than one location at a time, it has often been necessary to go through the time-consuming process of moving the paper-based work from one department to another. In some cases, departmental divisions have been created or maintained partly to make it easier to keep track of work stages and the physical location of the paper. With imaging's automatically generated audit trails, tracking the work is no longer a problem. And because supporting information is more easily accessible on the system, one department can handle the duties of several.

"You don't need all these specialized

departments, and you can eliminate the overhead involved in passing things between departments," said Joe Carter, managing partner and head of image processing and knowledge systems at Andersen Consulting in Chicago. At the Bank of Boston, image reengineering led to the merger of once-separate functional units under the Deposit Accounts Management department. Connecticut Mutual retained the separation but shrank the size of departments by as much as 40 percent.

THE corporate impact of image reengineering can be negative as well as positive. Ripples of change from one side of the company can swell into waves that rock, or even swamp, the boats of other departments.

For example, an image-inspired pro-



THORNTON MAY: *Imaging turns workers into decision makers.*

cess change proposed for one Bank of Boston department would have required a second department to provide greater detail on documents it had been supplying to the first department. That would have meant

Introducing Workware...

A new class of software tools helps imaging change the course of mighty rivers of human endeavor

Suppose your image system could automatically sort incoming documents (insurance-policy applications, for example), recognize which were worth the most potential revenue, route these to the best underwriters and prod the underwriters to get cracking on them. Image-processing vendors are now offering tools that can help companies redesign and automate their workflows to achieve this kind of functionality—a far cry from the storage-and-retrieval limitations of “electronic filing cabinets.”

Simply stated, workflow tools can

coordinate and carry out the routing, filing and queuing of document images based on factors such as their time-sensitivity or value. They can also record document audit trails and report any delays or other problems that pop up.

Connecticut Mutual Life Insurance Co. uses FileNet Corp.'s image system and workflow tool to automatically fill in forms with data pulled down from a host. This workflow automation, coupled with dramatic process reengineering, has shortened average claim-processing time from 21 days to three, according to Jan Scites, senior vice president and chief administrative officer at the Hartford insurer.

At Union Pacific Corp. in St. Louis, workstation users can simultaneously call up a bill of lading from a FileNet image system and a host-based spreadsheet of shipment totals. To reconcile the two, workers simply click off items on the bill. In response, the workflow software automatically updates the dollar values in the spreadsheet, explained Rex Cobb, Union Pacific image consultant.

Not every vendor's workflow tool is the same, nor is each suited for the same environment. Unisys' Event Manager, which began shipping early this year, is geared toward environments like health-claims processing, “where you do precisely the same thing with each piece of paper,” said Barry Lurie, director of strategic marketing programs for the imaging systems group at Unisys in Blue Bell, Pa. The product is less useful for ad hoc inquiries, such as arise in customer service, he said.

While many image users still perceive the technology as an electronic archiving system, that “view does a disservice to the technology,” said Joe Carter, managing partner and head of image processing and knowledge systems at Andersen Consulting in Chicago. With workflow software's automatic monitoring, routing and control, and built-in fax and E-mail interfaces, users can do many of the things they once had to hire systems integrators for, Carter said. If workflow software catches on, integrators as well as file-cabinet makers may have to start worrying.

—R. Pastore

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more work or additional staffing—an unaffordable consequence. Nor could the bank afford to install image in both departments at once. The solution was to modify the proposed changes, compromising between efficiency and the need to limit impact on other departments. “Now the rule [for image-process reengineering] is that it can’t cause anybody to add head count,” Flavin said. “You’ve got to draw the line somewhere, because otherwise it’s a huge job.”

With all the process changes possible, it’s startling that most users have been content to employ imaging as an electronic filing cabinet. Only by process reengineering can imaging’s true value be realized.

Connecticut Mutual also encountered negative ripple effects. When one workgroup converted to image, a separate non-imaged department found it no longer had access to documents the two once shared. Scites temporarily solved the access problem by installing extra image workstations, or “browse command centers,” for ad hoc use by non-imaged workers.

The danger that a little reengineering here can create unforeseen complications there intimidates many firms, particularly in this brutal economy. Add political fears over the consequences of transferring authority, and it becomes clear why most image users decline to brave the reengineering waters. Analysts estimate that only 10 to 30 percent of image implementers today make significant process changes.

Those numbers are trending up, however, thanks to hardware standardization, the more open nature of workflow tools and the good publicity provided by pioneer users, according to Michael Antonelli, manager of applications strategy and image solutions at IBM. “The seed has been planted, and it’s been growing at a rapid rate in the last couple of years.”

Users who first “paved the cow paths,” imaging their existing processes, may have realized a 5 to 20 percent productivity gain, Antonelli said. “Now they’re ready to shoot for more strategic and long-lasting gains in the 40 to 50 percent range” by reengineering their processes. Once they do that, they may set in motion changes that could alter the face of the corporate pond. 

Document-Imaging Workflow Software

Some leading products

COMPANY	WORKFLOW PRODUCT(S)	PLATFORM(S)*
Computron Technologies Corp. Rutherford, N.J. 201 865-8400	Epic/Workflow	IBM AS/400, Wang VS, DEC VMS
Digital Equipment Corp. Maynard, Mass. 508 493-5111	TeamRoute, Epic/Workflow	DEC VMS
DST Systems Inc. Kansas City, Mo. 816 435-1000	Automated Work Distributor	IBM AS/400
FileNet Corp. Costa Mesa, Calif. 714 966-3400	Workflo Business System	FileNet
Hewlett-Packard Co. Palo Alto, Calif. 415 857-1501	A1MS	Hewlett-Packard
IBM Armonk, N.Y. 914 288-3323	ImagePlus, ImagePlus/2	IBM MVS, OS/400, OS/2
Recognition Equipment Corp./Plexus Santa Clara, Calif. 408 982-4800	ImageFlow, XDP	DEC, Sun, Hewlett-Packard, Data General, IBM
Sigma Imaging Systems Inc. New York 212 467-3000	RouteBuilder	IBM OS/2
Unisys Corp. Blue Bell, Pa. 215 986-3432	Event Manager	Unisys
ViewStar Corp. Emeryville, Calif. 510 652-7827	ViewStar	IBM OS/2
Wang Laboratories Inc. Lowell, Mass. 508 459-5000	Third-party products (Epic/Workflow, IDM, Imagemover, Office Driver, and Y2K)	Wang

*All platforms supported may not be listed

Source: Ben S. Levitan, Andersen Consulting, Boston

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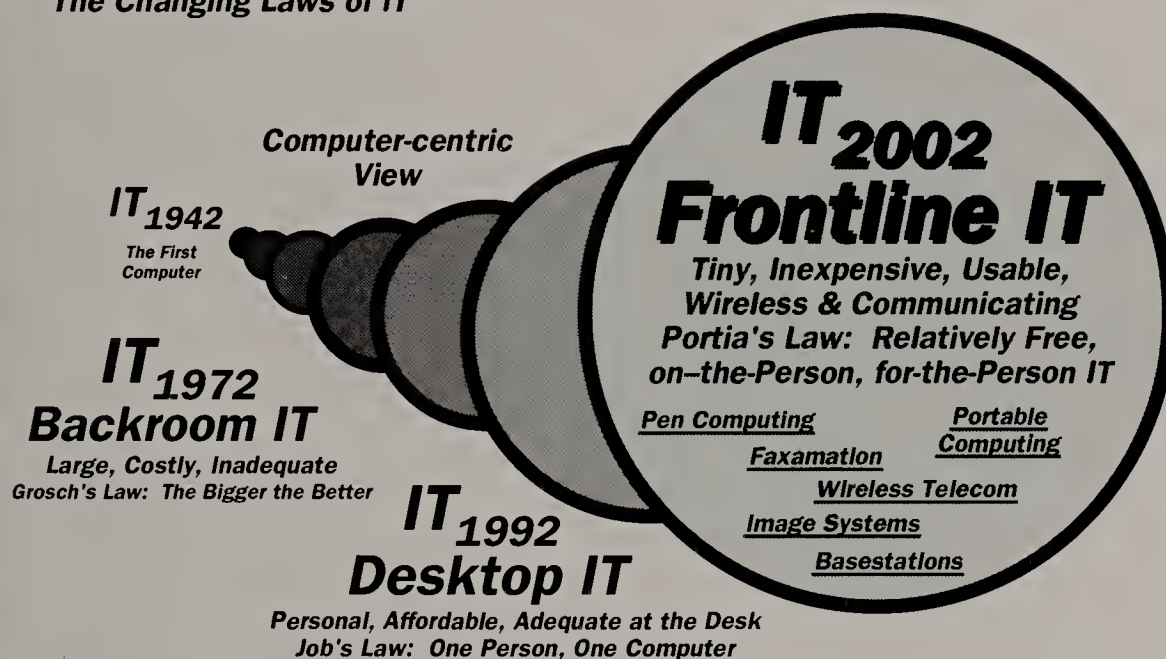
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NEW BONDS ON WALL STREET

BY DAVID FREEDMAN

Many observers now insist that racing competitors to computerize for strategic advantage is ultimately a self-defeating game that results in lower profitability for all the players. Of course, it is no longer possible to compete without investing heavily in IT platforms that boost efficiency and offer additional value to customers. On the other hand, who says that companies have to try to out-muscle one another in individual efforts to develop these platforms? What if several companies in an industry got together and pooled their resources to develop a common IT infrastructure, putting an end to the no-win war to computerize while achieving those benefits that are crucial to doing business?

That, in a nutshell, is the story behind Electronic Joint Venture (EJV) Partners, a venture that may represent the new paradigm for large-scale IT efforts in the 1990s. Jointly owned by six major Wall Street firms—CitiBank, First Boston Corp., Goldman Sachs & Co., Morgan Stanley & Co., Salomon Brothers Inc. and Shearson Lehman Brothers Inc.—EJV was formed to provide a critical information and communications infrastructure for key segments of these companies' bond-trading businesses. The result, which is just now coming online, is a system that allows bond dealers to de-

Six Wall Street firms have found that when it comes to information technology, working hand-in-hand with the opposition can be highly competitive





RANDALL HOYLE (left) and **STEVEN RUEGNITZ** believe that companies in all industries will eventually follow the example of EJV, turning to partnerships to build the systems that link them with customers and suppliers.

liver a variety of data and analysis services to customers. Will EJV's highly integrated platform and sophisticated network make much of an impression on Wall Street's technology-jaded denizens? "People are going to be amazed," said Steven Ruegnitz, director of operations for EJV.

Not every player in the bond-trading business is a partner in EJV. But so much the better for the six founders. Not only will the enterprise help fend off threats from third-party information providers whose services could indirectly siphon off business from the dealers, but it also gives partners what may be a truly sustainable edge over the rest of the field. Of course, the competition is welcome to join up—at a price that allows the partners to recoup some of their costs, and more. In fact, EJV has already signed up its first non-partner dealer—J.P. Morgan & Co.—as a customer. "We're

not looking for other partners anymore," said Randall Hoyle, EJV senior vice president of operations and technology. "The partners intended for us to turn a profit, and that's what we're going to do."

EJV was set up specifically to support the bond-dealing efforts of its partners. Bond dealers provide the link between two different types of clients. On the sell side are the institutions issuing the bonds; these include government agencies, corporations, mortgage pools and other sources. On the buy side are the pension funds, institutional investors and other parties that want to purchase the bonds in large quantities. Bond dealers don't necessarily have a stake in

the ups and downs of the bonds themselves; instead, they are market-makers—in effect, they simultaneously buy and sell large blocks of bonds, attempting to profit from the spread in the bond-issuer's selling price and the presumably higher price at which the bond is sold to the buy-side customer.

It's a tricky business—and one in which—as with most complex financial services—providing information plays a critical role. Making bond-purchasing decisions is a complex process for customers, requiring detailed pricing and other data on a variety of bonds, as well as sophisticated tools to analyze the data. A bond dealer that could provide its clients with these data and tools would have an edge over firms that couldn't. Indeed, a few firms have already established electronic links to their clients for this purpose, a clear start for the industry down the classic path of dueling strategic systems.

As with most other industries that have gone down this path, it is unlikely that any one player would stay out in front for long, since its competitors would spend heavily to catch up. In the end equilibrium would be restored, but everyone's profits would be lower in the aftermath of a largely redundant IT feeding frenzy. In fact, many Wall Street departments had already seen this happen in other areas. "Firms have been putting their resources into IT efforts that always turn out to be commodity products," said Hoyle.

Bond dealers had another threat to contemplate: Some information service companies were providing bond data and analytics to a growing number of buy-side customers. Not only did such third-party ventures potentially weaken the link between bond dealers and their customers, but they also provided a means for some firms to get ahead by offering to handle bond trading in conjunction with the information services. One such partnership be-

tween bond-dealer Merrill Lynch and information provider Bloomberg Financial Markets was already a source of concern to some firms.

After the 1987 crash, the six firms that were to found EJV began to look for a way to respond to such competitive threats without having to take on individually the burden of developing a large, costly infrastructure to support it. "They realized they were spending resources to do generic things," explained Ruegnitz. "By sharing the investment, they could create big efficiencies for themselves and their subscribers." Their ambitious plan: to build from scratch a sophisticated, comprehensive platform for storing and disseminating a broad range of bond data acquired from all the partners, and to make it available to all their customers.

At first, the system would provide pricing and analytics for bonds and other "fixed income" securities—that is, financial instruments that, unlike stocks, guarantee their holders a pre-

Not only will the enterprise help fend off threats from third-party information providers, but it also gives partners what may be a truly sustainable edge over the rest of the field.

TAKING STOCK OF EJV'S STRATEGY

■ **Pick your fights carefully:** EJV isn't trying to provide a complete range of IS services; most partners already have the basics well covered. Instead, it is focusing on a narrower range of more sophisticated IS-based products that will complement partners' offerings and distinguish them from competitors.

■ **Pool expertise as well as funding:** EJV's management made sure that all the partners shared their expertise, allowing the venture to emulate partners' successes and learn from their mistakes rather than repeat them on a bigger scale.

■ **Give partners flexibility:** To make sure the venture's efforts are not ignored by partners enamored of their individual approaches, EJV designed its offerings so that part-

ners can pick and choose pieces that best complement their own systems.

■ **Build from scratch:** Though it's tempting to build on existing platforms, starting from square one enabled EJV to take better advantage of newer technologies such as cooperative processing, automated operations and graphical user interfaces.

■ **Build open systems:** While EJV's partners might never have agreed on a proprietary environment, nobody had strong objections to Unix. And while Unix may still lack the range of software offerings provided by some proprietary environments, its flexibility affords easy mixing and matching of platforms and technologies.

■ **Let others join—at a price:** To avoid costly IS wars, EJV intends to make its system the industry standard by allowing competitors to use it. The only catch: Newcomers must pay for the privilege of participating, which means that the partners should eventually turn a handsome profit.

■ **Don't think it doesn't apply to your industry:** The financial industry, with its information-intensive nature and large IS budgets, is a natural for pioneering this sort of joint venture. But EJV's managers believe that companies in all industries will eventually turn to partnerships to build the systems that link them with customers and suppliers. If they're right, the only question is whether you become an owner or a renter.

“They realized they were spending resources to do generic things. By sharing the investment, they could create big efficiencies for themselves and their subscribers.”

—Steven Ruegnitz

determined amount of money. Later, the partners decided, EJV could add online bond-trading. And why stop with fixed-income securities? “Eventually, we plan on doing it all,” said Ruegnitz.

Not that these six firms planned to stop competing on IT, or on anything else. Rather, they were determined to pick their fights more carefully. “They wanted to free up the resources being spent on platforms so they could concentrate on the really competitive pieces—the creation and analysis of new financial instruments that take advantage of assets,” said Hoyle. “They’re looking for new places to add value on top of the baseline platform.” Furthermore, added Hoyle, pooling resources would enable the creation of a better platform than anything any one of them could have built on its own. “The partnership provided a critical mass that allowed solving the problems. They weren’t just pooling financial resources, but they were also sharing their insights into IT, the trials and tribulations of their own efforts.”

It’s not the first time that Wall Street firms have talked about merging certain back-office operations. But

other efforts have been scuttled by a range of difficulties: an inability to integrate disparate databases, concerns over the misrouting or interception of proprietary and other confidential data, the challenge of delivering so much data over a network in a useful and cost-effective way. “It’s extremely technically difficult to merge information from several sources into a high-level system for a variety of applications,” noted Ruegnitz.

Fortunately, the technological bag of tricks from which EJV has been free to draw is considerably fuller than it was even two or three years ago. For one thing, cooperative processing has recently gone from pipe dream to battle-tested architecture, complete with sophisticated security features that allow one partner to send proprietary data to a customer over the common network with little fear of pirating. And perhaps most important, open systems have suddenly exploded into acceptance. “We are absolutely rabid open-system devotees here at EJV,” said Ruegnitz. “We wanted to move to a completely distributed environment based on the client/server model, and that would have been extremely difficult to implement in a proprietary environment.”

The client/server approach is not simply a major element of EJV’s overall architecture; it is the architecture. “We tried to get completely away from mainframe/mini thinking,” explained Ruegnitz. “We wanted to do the processing wherever it makes sense—and especially on the desktop whenever possible. If a customer wants bond prices, the data is shipped down to his desktop workstation from a local server. Then any time he wants to look at those prices, he can get them from the desktop. When the prices change, they are updated on the server, and the customer is sent a message notifying him of the updating, so that he can decide when he wants to have his desktop database updated.”

The system is designed to be delivered to standard Unix workstations—preferably those that are al-

TECHNICAL PROFILE

Electronic Joint Venture (EJV) Partners was formed by six Wall Street brokerages to provide customers with online, real-time information about bonds and other fixed-income financial instruments downloaded from the partners’ databases and other sources. In order to do this, EJV has established a network that links the partners’ systems to its own data center, and the data center to its customers via a client/server architecture. The only information EJV will release about finances is that it is intended to operate at a profit.

Large and Mid-Range Systems: EJV’s highly automated data center is based on Digital Equipment Corp. VaxClusters. Customer sites are equipped with Sun SpareStations acting as servers. The company declines to give specific numbers.

End-User Computing: Customers will at first be required to tie into the servers with Sun workstations, but EJV says they will soon be able to use any workstation that runs Unix.

Software: All of EJV’s systems are designed around the Unix environment, with mostly custom-developed applications.

Networking: Partner-to-data-center and data-center-to-server communications are almost all via T1 lines; server-to-workstation connections are via local area network. The entire network operates under the TCP/IP protocol.



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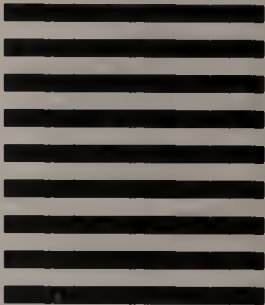
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ready sitting on the customers' desks. In that case, all that's required is installing a Unix server at the customer site and loading the software into the workstations. "Unlike many other data services, we're not making any assumptions about owning the customer's terminal," said Ruegnitz. "We'll run alongside their word processing and spreadsheet software on the same box, as a different application."

EJV hasn't been able to completely escape the burden of a data center, though it has considerably downgraded its focus compared to conventional systems. "People always want to have a glass house they can put their arms around, so they can have a clear, centralized concept of a transaction," noted Ruegnitz. "But where is that carved in stone?" EJV uses its Jersey City, N.J., data center as a relatively passive data repository.

Determined to keep the data center from serving as a sinkhole for staffing costs, the company invested in automated operations; if a problem crops up that the software can't handle itself, the system dials a number and sends a message to pagers carried by off-site technicians and analysts. Thus while large systems typically require one staff person for every 12 workstations supported by the system, EJV is running with a ratio of less than 1-to-100.

In keeping with the philosophy of minimizing the number of people that come between customers and the system, EJV set out to create application software that requires little training, adhering to standard Unix graphical user interfaces. "We wanted software that would be completely intuitive, which is something that most people in this business have never had before," said Hoyle. They need little or no training to get started on the system. And if they do encounter a problem, an EJV employee can quickly tap into the user's screen remotely to assess the situation and guide the user through the difficulty.

Ruegnitz admits that EJV had an important advantage over organizations that have produced less im-

pressive results. "This was a scratch build," said Ruegnitz. "IT people usually start out on someone else's playing field. This was the first time in my career where the only thing on my desk in the beginning was a number 2 pencil. We had some of the best people in the business sitting around this table over pizza trying to figure out the best way to meet user needs, with no constraints."

On the other hand, given how hard it is for one company's managers to make up their minds about IT, you might think it would be IT hell to get six highly opinionated organizations to sign off. Not a bit of it, swears Hoyle, who credits the adherence to open systems as one key factor.

"It would take Genghis Khan to get six major companies to agree on a single, proprietary solution for a common back-office operation," he said. "But the partners have been uniformly supportive of the common platform. Sure, there are occasional sticking points—some of the partners prefer to have their customers tap into different sources of market data than the ones we selected, for example. But open systems means open choices; they can provide their customers with access to anything they want."

Could this work in other industries? Absolutely, insisted Ruegnitz. "I was with a vendor before I came to EJV, and I worked with customers from a lot of different industries," he said. "Time and time again I came across the same picture: the need to link up different segments of the business. Auto body shops would like to connect to paint and parts vendors; hospitals need to talk to doctors and blood banks, and so on. And they could all do it in the same way we have."

If that's true, then CIOs can start looking forward to finding other uses for all that money they've been throwing at mythical competitive-edge systems. ☐

David Freedman is a freelance writer based in Brookline, Mass.

"IT people usually start out on someone else's playing field. This was the first time in my career where the only thing on my desk in the beginning was a number 2 pencil."

—Ruegnitz

Simplify, Simplify

RISC technology is more than just another notch on the price-performance curve—by simplifying complex instructions, computer makers are changing the economics of processing

BY DAVID FREEDMAN

In the good old days, most IS managers could cite the salient characteristics—if not the intimate details—of the IBM main-frame instruction set, that group of ultra-low-level processing operations built into the processor circuits into which all programming steps are ultimately broken. And that wasn't just because IS managers used to come up through technical ranks; back then, changes to the instruction set directly affected hardware and software decisions and had an impact on the entire economics of corporate information processing.

Now, in the era of cheap MIPS, CIOs spend far more time worrying about balance sheets, distribution channels and corporate restructuring strategies than about hardware. And when they do think about hardware, it's at the highest architec-

tural levels. As for instruction sets well, that's something that happens down on chips. It may as well be happening on another planet.

Reduced instruction-set computing (RISC) which, simply put, means getting rid of all but the simplest basic hardware operations in an effort to make a computer go faster might be viewed as just another one of those black-box factors that have led to the doubling of computing price-performance every two years, an improvement rate that would explode eyeballs in any other field but elicits yawns in this one. Actually, though, RISC is far more—and, for that matter, far less—than just another notch on the price-performance curve. It is a technology in the midst of fundamentally changing the way companies think about IS, and it is turning the computer industry on its ear.

Why far less? Because RISC is actually a throwback to earlier days of computing. As Josh Fisher, a research scientist at Hewlett-Packard in Palo Alto, Calif., put it: "RISC is more of a reactionary move than a revolutionary one." Instruction sets in the 1950s and much of the 1960s were bare-bones, merely telling the computer how to pull a nugget of data in and out of memory, how to add two numbers, and the like. Then, in the mid-1960s, IBM threw in a large number of more complex instructions, each of which incorporated a distinct combination of simpler instructions; the idea was that the processor could execute one complex instruction far more quickly than it could the several simpler ones it replaced. It seemed to make so much sense that virtually every computer manufactured in the 1970s was a CISC (complex instruction-set computing) machine, led by the IBM 360 architecture processors and the Digital Equipment Corp. VAX.

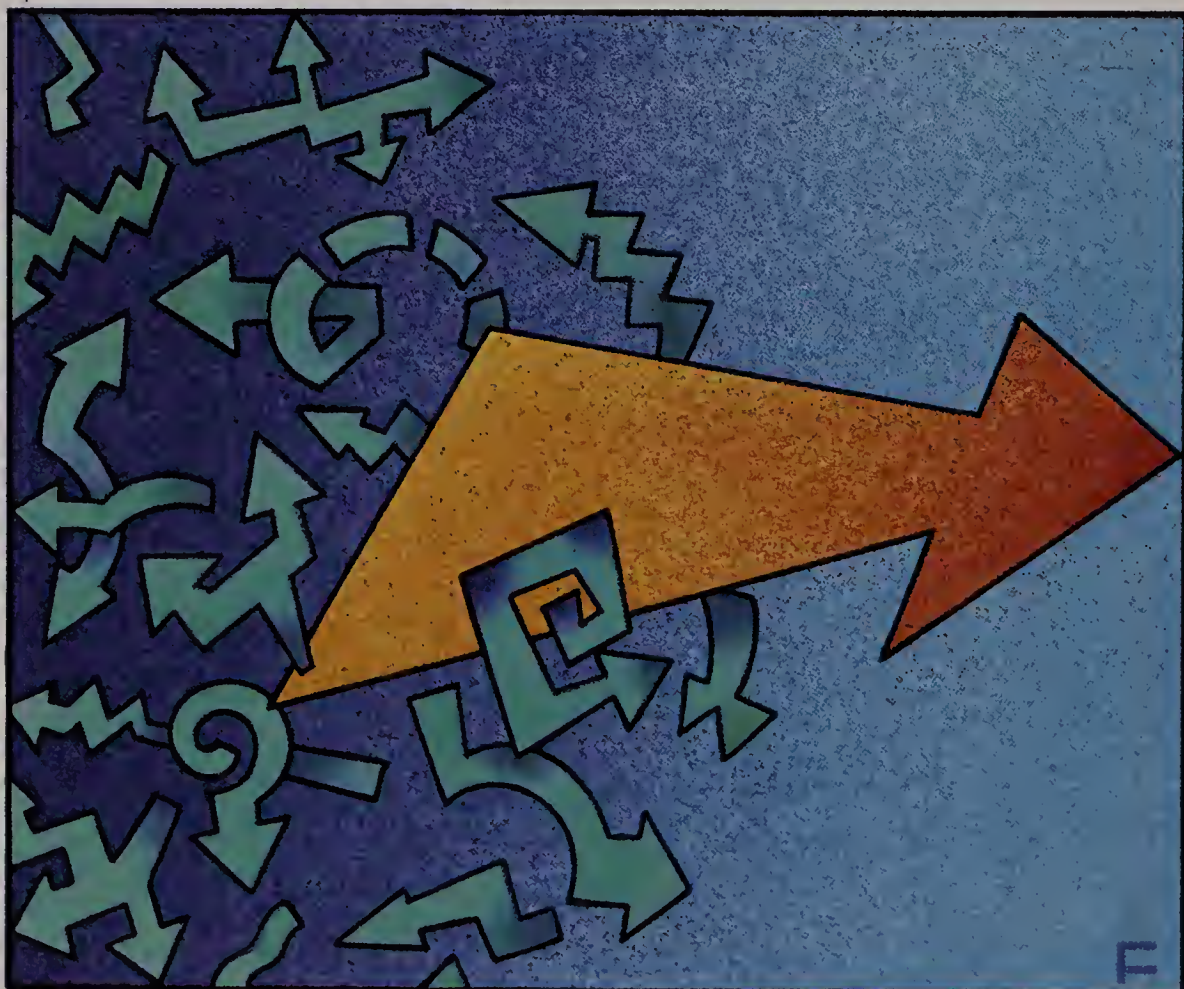


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At first it looked as if the 1980s would bring more of the same, given the continued success of the 360 architecture and the VAX, not to mention the spectacular rise of the CISC-oriented X86 microprocessor from Intel. But research projects at IBM, Stanford University and the University of California at Berkeley threw a monkey wrench into the computer culture. Computer scientists at all three had noticed that while CISC looked great on paper, in practice the complex instructions often remained unused because software programs always seemed to call for a sequence of operations that was just a little different from any of the pre-fab complex instructions. As a result, the processor usually ended up stringing together simpler instructions anyway. Yet whether they were employed or not, complex instructions took up a great deal of space on the chip, entailing a significant overhead in processing speed. It was sort of like paying to lease a BMW and leaving it in the garage while driving around in a Hyundai.

The solution was obvious: simplify and speed up the chips by dumping the complex instructions. It might not sound like rocket science, but it was news to everyone at the time. "Pointing out the concept had a tremendous effect, because suddenly there seemed to be an alternative," recalled Fisher. "For most of the 1980s there were instruction-set religious wars; now hardly anyone thinks CISC is the way to go."

The impact on the industry has been profound. In fact, there is a very rough correlation between how early and fully computer manufacturers committed to RISC and how they've fared in the past few years. Hewlett-Packard, for example, was inspired by the research done at Berkeley, Stanford and IBM and incorporated it into its "Precision Architecture" RISC machines, a move that has propelled the company close to the forefront of the industry and allowed it to defy the slump. Start-up MIPS Computer Systems Inc. in Sunnyvale, Calif., commercialized the Stanford technology in a set of RISC

Thanks to RISC, in a few years computers could be at least 10 times as powerful and just as cheap.

chips that many now consider to be a RISC standard, and that has made MIPS an industry force. In contrast, RISC ignorers like Digital and Apollo got creamed in the all-important workstation market. (Digital's upcoming "Alpha" workstations will be RISC-based). Sun's recent mixed fortunes perhaps reflect its late, albeit enthusiastic, conversion to RISC. As for IBM, it blew its early RISC lead on the disastrous RT workstation but recovered somewhat with the RS/6000 RISC workstation.

The big exception to the rule is, of course, Intel. Its current X86 chips are pure CISC, and despite Intel's claims to the contrary, industry experts say the '586 will not bring the company any closer to RISC. (The company also offers a RISC chip, the i860, but it hasn't made much of a splash.) Intel still dominates the microprocessor market, but can CISC-based machines continue to compete? For a while, say most observers, given business's huge investment in the X86 architecture. But RISC will inexorably eat away at the X86's market share, a trend that's already begun. "Intel has managed to dominate the sweet spot of computing," said Skip Stritter, vice president of business development and a cofounder of MIPS, "but they're under attack from RISC."

All this has a huge impact on how businesses approach IS. RISC, far more than any other single technology, has made network servers with mainframe-like horsepower available for a few times the cost of a PC. Thus the economics of processing is for the first time leaning strongly toward a distributed, networked model. In addition, RISC chips have

not been designed to run proprietary software environments, and so cry out for open systems.

Of course, businesses have long sought a move to open, distributed architectures for their own reasons. But until recently, the technology tended to fight this trend. RISC reinforces it. It is not surprising that organizations leading the move to open, client/server architectures typically build their efforts around RISC machines, often achieving along the way a marked improvement in the way they do business. American Airlines, for example, has pulled its processing-intensive but strategic aircraft-scheduling applications out of a batched mainframe environment and put them onto machines based on the MIPS chip set, allowing schedulers for the first time to interact with the data online. Without RISC, the move might not have been cost-effective, or even possible.

RISC is just warming up. With improvements in chip technology allowing more transistors per chip, and with RISC reducing the number of transistors required per processor, a single chip will soon have enough space to contain entire computers—including communications modules, vast cache memories and all sorts of supplementary processors. "The threshold for doing that seems to be getting one million transistors on a chip, which is where we are now," said MIPS' Stritter. The pared-down nature of RISC also makes it far easier to implement instruction-level parallelism, in which a single chip is able to simultaneously execute several instructions from a program. All this means that in a few years, computers could be at least 10 times as powerful and just as cheap.

Stifle that yawn. You can't have access to those kinds of improvements without expecting to have to rethink your computing strategies. Of course, you could always sit back and wait and see what your competitors do with all their ever-cheaper MIPS. 

David Freedman is a freelance writer based in Brookline, Mass.

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Radio Days

Marconi never dreamed of this! Norand Corp., based in Cedar Rapids, Iowa, has just released a family of portable, radio-controlled products for use in warehouse or retail operations. The company's RC3250 Universal Network Controller—which controls the timing, data flow, and protocol conversion that allows radio-frequency (RF) data terminals to talk to host computers—will support two simultaneous host connections and up to 64 RF terminals per host. The controller also supports applications using dual frequencies. Serving SNA protocols (and soon TCP/IP), the controller will link up to IBM, DEC/VAX, HP-3000 and UNIX-based systems.

Norand also offers a 15-ounce modular hand-held data terminal, the RT/DT1100. The terminal comes equipped with a liquid crystal display and a 47-key alphanumeric keyboard, for use in retail jobs such as order entry and inventory, or industrial jobs such as order picking. The pocket-sized terminals can also be fitted for integrated CCD scanning—and can read standard bar codes from a distance of up to one inch.

Rounding out the new releases, Norand offers a mobile-mount terminal for harsh forklift-mount applications, and a radio-frequency data-communications tool for use in hazardous locations. For more information call 800 553-5971.



Seeing and Being Seen

Having a good telephone manner is no longer a matter of voice alone. With a new videophone system offered by Compression Labs Inc. (CLI), callers can now be seen as well as heard.

The Cameo Personal Video System Model 2001 is CLI's initial effort in a family of interactive desktop video products. The Macintosh-based system provides two-way color motion video over ISDN basic-rate interface circuits. Video communications are user-controlled and take place in a window on a PC monitor.



Other applications can be active during a video call, and callers can transmit data from the screen to the receiving party.

The 2001 incorporates basic telephone features including a directory with auto speed dial, a hold function for audio and video, audio mute and automatic redial.

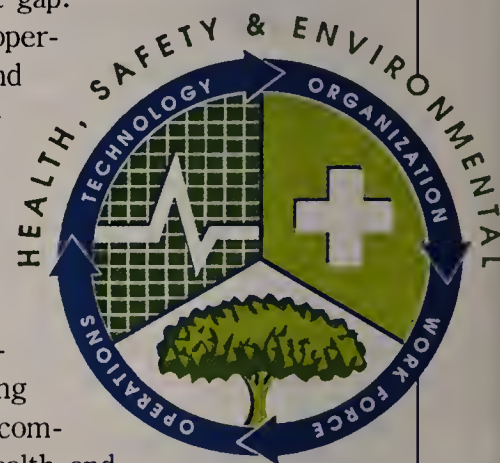
The system requires an ISDN NB card, a standard telephone line and a Macintosh IIci, IIx or Quadra running System 7 with QuickTime. Retail price is \$2,095. For additional information call 800 225-5254 or 408 435-3000.

Process Makes Progress

In the past, it paid to be discrete. Integrated packaged-software solutions have historically been aimed at discrete manufacturers, while process industries like chemicals, textiles and pharmaceuticals have been left out in the cold. Andersen Consulting's new Process/1 was designed to help those manufacturers fill that gap.

Process/1 allows companies to support distributed plant operations while maintaining critical linkages with enterprise and control systems. The product's client/server architecture supports multinational operations with such features as multicurrency, multilanguage and unit-of-measure conversion.

Process/1 includes five business-application areas: plant operations; customer service and logistics; resource planning; product and financial management; and environment, health, safety and training. Andersen says it is the first application software of its kind to integrate EHS&T processing with manufacturing operations, providing automatic assists in complying with environmental regulations and promoting the health and safety of employees. The initial release of Process/1 is available on Digital VAX computers. Pricing begins at \$150,000 and depends upon processor size. For more information call 800 541-7512.



For Inquiring Minds

What the hell's with this data!?" Though perhaps the most common data-analysis query, this wouldn't elicit much of a response from natural-language data-analysis tools. But with a few more specifics and a little less invective, one might ask, "What is the gross margin and ROI for the top products for the third and fourth quarters?" The latter inquiry is a real-life example of the type handled by Occam Research Corp.'s recently released data-analysis and -reporting tool, MUSE.

MUSE assembles data from diverse database sources into "databooks," which appear to users as a single large pool of information ready for ad hoc access and analysis. MUSE's natural-language data dictionary expands with use to reflect how each individual user thinks and works. The system automatically incorporates routinely used terms, lists and values.

The \$695 software for the Apple Macintosh is available through retail outlets or by calling 617 923-3545.

EVENTS

Business Process Reengineering from Concept to Execution

Sheraton Boston, Boston
April 9-10
Chicago Hilton & Towers,
Chicago
July 30-31
Digital Consulting Inc.
508 470-3880

This seminar defines the critical success factors behind the effective reengineering of a company's business processes. Focus is on the relationship between processes and support systems, methods for working, procedures and tools for process modeling, the rationale behind and benefits of each aspect of methodology, and total-quality management, CASE and other state-of-the-art approaches. Registration fee: \$895.

ASM's 45th Information Systems Conference

Queen Elizabeth Hotel, Montreal,
Quebec
May 3-6
Association For Systems
Management

This conference is designed for

information systems management and business professionals who manage information technology. There will be four keynote presentations, a forum addressing executive concerns, and more than 30 concurrent sessions on IS applications and issues. Registration fees: \$675 for members; \$775 for non-members.

EDI '92: Five Years of Breakthrough Thinking

Seattle Sheraton, Seattle
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Data Interchange Standards
Association
703 548-7005

This conference, with 66 sessions in 11 tracks, addresses the electronic data interchange educational needs of key industries including banking, transportation, insurance, retail, aerospace and communications. More than 100 corporate executives will speak. Also featured is an exclusive "view from the top" presented by CIOs, CEOs and vice presidents. Registration fees: \$535 for members; \$595 for nonmembers.

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Taking Care of Patient Data

Lutheran Hospital's bedside computing system has helped free nurses from time-consuming clerical work so they can take better care of patients. Doctors and other staff have ready access to accurate, complete data, and overtime costs have been significantly reduced.

Paperwork is the bane of a nurse's existence. Particularly burdened are intensive-care nurses; according to several industry reports, they spend anywhere from 20 to 50 percent of their time collecting and recording information. At one Wisconsin hospital, such a routine is a thing of the past since a bedside computing system arrived on the scene. Now nurses are liberated from many clerical tasks, and they have more time to devote to hands-on patient care.

In 1990, the 15-bed intensive-care unit at Lutheran Hospital-La Crosse installed the CareVue 9000 clinical-information system from Hewlett-Packard's Medical Products Group in Andover, Mass. CareVue runs in a client/server architecture and consists of LANs, cart-mounted bedside workstations with color monitors and two central servers.

Electronic replicas of Lutheran's 24-hour flow sheet are created with configurable software. Patient data such as vital signs, medications, lab results, treatments and

progress notes are charted and updated several times each day. According to Mary Lu Gerke, the patient-care coordinator of the ICU, nurses spent more time completing such documentation than on any other paperwork. In fact, the ICU staff typically required six hours of daily overtime to complete charting activities.

With CareVue, information is collected in a variety of ways and recorded in graphical and tabular formats. Nurses use a traditional keyboard to type notes, or they use a trackball to select items from a user-defined library of terms. In addition, other information—heart rate, blood pressure, temperature—is automatically logged into the system from integrated bedside monitors. All data is locally accessible to physicians and other staff.

"The objective was to decrease the amount of documentation time by 10 percent," Gerke said. This would alleviate overtime and free nurses up for what in hospital parlance are called activities of daily living (ADLs)—duties such as changing linens, helping patients eat and giving baths. In actuality, documentation time decreased by nearly 22 percent, allowing nurses to double the number of ADLs performed and eliminating all over-

time related to charting.

The system has solved other problems as well. Illegible or missing charts no longer hinder communication. And data is recorded more accurately and completely because nurses are prompted with a checklist of precise options.

Moreover, "we're collecting more data than we did in the past," Gerke said. (According to one study, the electronic charting system captures 50 percent more patient data.) With more-complete records, Gerke finds it easier to conduct medical-bill audits with insurance companies and third-party reimbursers. For instance, "there's no question what equipment was used or when," she said. "It's all right there in the charts."

In the past, paper records had to be scoured for such data. Gerke personally saves one to two hours

VITAL STATISTICS

Organization: Lutheran Hospital-La Crosse, La Crosse, Wis.

Application: Clinical-information system

Scope: Nurses, physicians and respiratory therapists in the intensive-care unit

Sponsors: The hospital's board of directors

Technologies: LANs connecting Hewlett-Packard 9000 series workstations and servers running H-P software

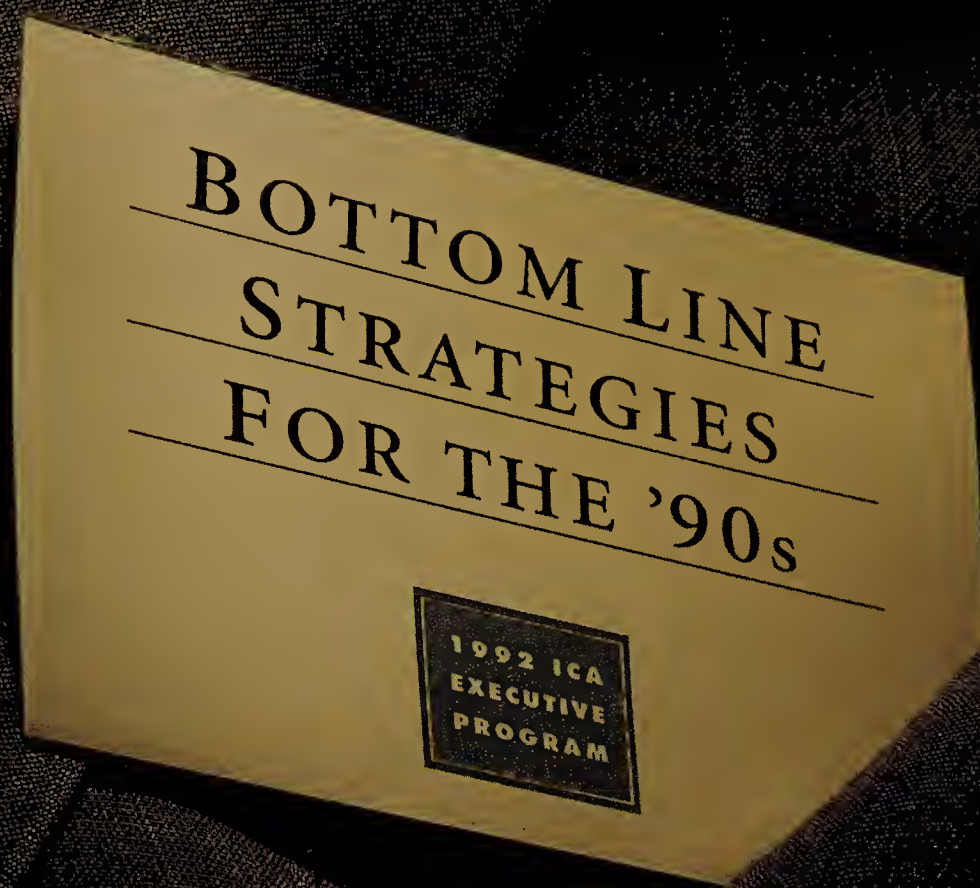
Objective: To decrease the amount of time nurses spend on patient-related documentation and clerical activities

Payoff: Data integrity has improved, and the time nurses spend on clerical activities has decreased dramatically. This has enabled nurses to spend a corresponding amount of time fulfilling their primary function: providing direct, hands-on nursing care.

per week on audits, and the hospital is studying ways to exploit the system for further savings.

An 11-year veteran at Lutheran, Gerke is convinced that CareVue has improved turnover rates and boosted morale among her staff. "There have been no problems in learning to use the system," she said, "and it certainly helps to recruit people."

—Megan Santosus



IT MAY BE THE DIFFERENCE BETWEEN STAYING IN THE DARK AND STAYING IN THE BLACK.

"Bottom Line Strategies for the '90s," the ICA 1992 Executive Program, will shed light on technologies that make a difference where it counts.

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DATES: May 18 – Registration/Reception/Dinner; May 19 – Program; May 20 – Tour of ICA Expo. PLACE: Hyatt Regency, Atlanta, Georgia. COST: Free to ICA member company executives; \$250 for nonmember company executives.

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